THE ELECTRICAL WORLD

A Weekly Review of Current Progress in Electricity and its Practical Applications

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The Edison System on Board Steam Vessels.

The Edison system of electric lighting has contributed largely to demonstrate the merits and advantages of the electric light over all other means of illumination for steam vessels, by the uniform success and satisfaction which have attended its use in marine installations. Assuredly it needs but an installation like that on board the Pilgrim to prove the general practicability and the desirability of the electric light for steam vessels of all kinds, and at the same time to bring into relief the particular excellence of the Edison system for the purpose.

Although we gave in our issue of June 23 an extended notice of the installation on the Pilgrim, which was a thorough enough review of the peculiar features of this electric lighting feat to call forth from the officials of the Edison company the compliment that it was the best account yet published on the subject, and which also enjoyed the distinction of being reproduced by several of our foreign exchanges, we had nevertheless proposed to enlarge still further on the installation, with illustrated descriptions of the apparatus used. Meanwhile, however, installations of the Edison system have been in progress on several other vessels, and the details and data made accessible to us concerning them reveal some novel features of value. In view of the fact that the adaptation of the electric light to navigation is an important question at the present time, and one which is being made the subject of comparative study by electricians as well as ship owners and ship builders everywhere, we thought that a comprehensive review of all these installations, with illustrations of the principal apparatus used, would afford our readers a better idea of the nature of the problem, and, at the same time, of the adaptability of the Edison system to its requirements. The installations which we shall notice have either been lately completed or are in process of completion, and consist of one ferryboat, one United States man-of-war, and three merchant and passenger steamships. The apparatus used in these installations is the same as was used in the Pilgrim, with some exceptions. We shall, therefore, refer to the Pilgrim plant only casually to point out the differences.

FERRYBOAT FANWOOD.

The installation on board the ferryboat Fanwood, of the Communipaw Ferry line, operated by the Central Railroad of New Jersey, is the first we shall describe. The plant comprises 60 lights operated by one dynamo-electric machine of the type known as "Z" (Fig. 1), placed in the hold of the Fanwood. It is, of course, impossible to do full justice to the Edison machines in the limited space allowed by a general description like the present. We shall confine ourselves to a brief glance at their most salient features. The "Z" machine consists of a tall, upright U magnet, in the magnetic field of which revolves a cylindrical armature. The pole pieces rest on the iron base of the machine, a thick piece of non-magnetic material being interposed so as to prevent the short circuiting of the lines of force between the two pole pieces by the iron of the base. The cores of the electro-magnet consist of two thick iron pillars *A A* connected together above by a thick block of iron *K*, on one surface of which a board is attached, this board serving to receive the switch and binding posts. The field is wound in several sections, and these are connected to the armature in derivation so that the machine is technically what is known as shunt-wound. The machine is about six feet in height and weighs 3,000 pounds. It occupies a floor space of 45 × 39 inches. The regulation of the current is effected on the Fanwood by introducing resistance into the field circuit. This is done by means of a hand regulator (Fig. 4) or rheostat. This consists of a box containing resistance wire in small sections looping between contact pieces disposed in a circle on the top of the box.

The field magnet wire of the dynamo goes to a binding post on each side, and one of these binding posts is connected by wire with one end of the resistance wire in the rheostat box, the other being connected to the pivot of the radial contact lever, which touches the contact segments and completes the circuit. By turning the switch lever the amount of resistance introduced may be varied to any extent required.

The armature *B* is of the cylindrical kind, and recalls the Alteneck armature in appearance. It differs materially, however, both in structure and in method of winding The core is composed of thin discs of sheet-iron insulated from each other by paper discs and strung together on a wooden mandrel, through which passes the shaft. By thus constructing his cores of isolated pieces, Mr. Edison obviates in a great measure the occurrence of Foucault currents, and to this is due the comparative absence of heat in the armature, even after it has been running several hours. The armature, which is ten inches in diameter, is wound in 54 sections that loop between the commutator segments, as in Alteneck armatures, but the "diagram" of winding is different, and is of Mr. Edison's invention. An excellent feature in the construction of these armatures is the covering of stout canvas, which fits over the ends closely. This not only protects the connections from accident, but prevents the churning of the air, which is noticeable in uncovered armatures, and which is undoubtedly accountable for the absorption of some mechanical energy without useful return. Mr. Edison adopted a different course also in disposing both the commutator and the pulley (*P*) inside of the bearings. We have no doubt that the arrangement presents advantages over the other way of placing the commutator and pulley outside of the bearings. The conductors from the collecting brushes lead up to insulated binding posts *C D* above. One of them includes a hand switch, by turning which the circuit may be opened or closed.

The dynamo is worked by means of an Armington & Sims high-speed engine of a type specially designed for electric light purposes, and shown in Fig. 15. This engine is of the class designated "B" by the makers, and has a cylinder 8½ × 10 inches.

These engines are remarkably small and compact in design, weighing about 4,000 lbs., and occupying a floor space of only 46 × 90 inches. The engine is characterized throughout by excellent adaptation of parts and skillful workmanship, an excellent proof of which is the fact that when running at the speed of 320 revolutions, as in this case, it can scarcely be heard. The chief feature of excellence of these engines, however, and that which probably determined their adoption by the Edison company, is the precision with which the governor performs its functions. The principle on which these engines are

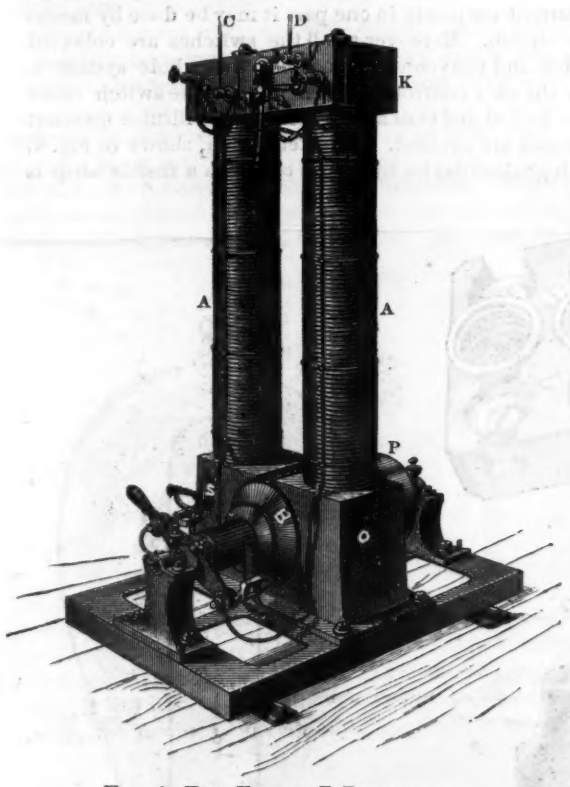

FIG. 1. THE EDISON Z DYNAMO.

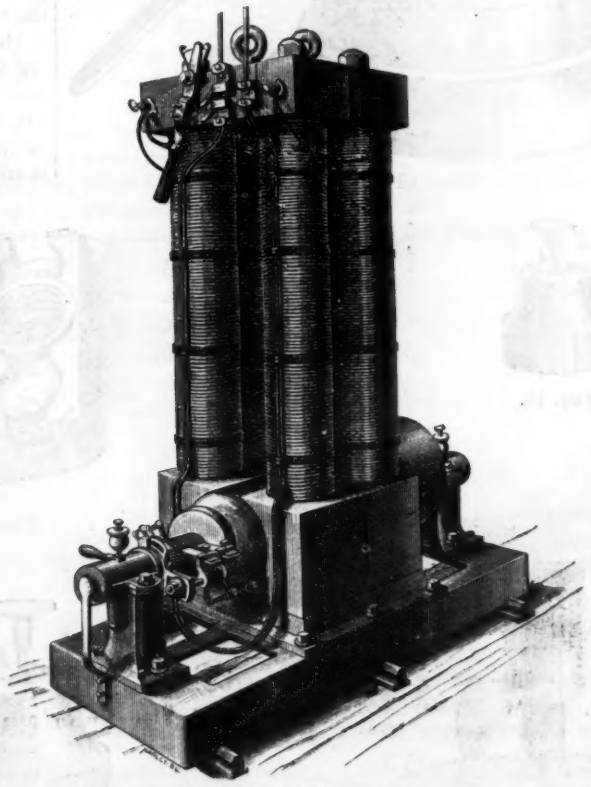

FIG. 2. THE EDISON L DYNAMO.

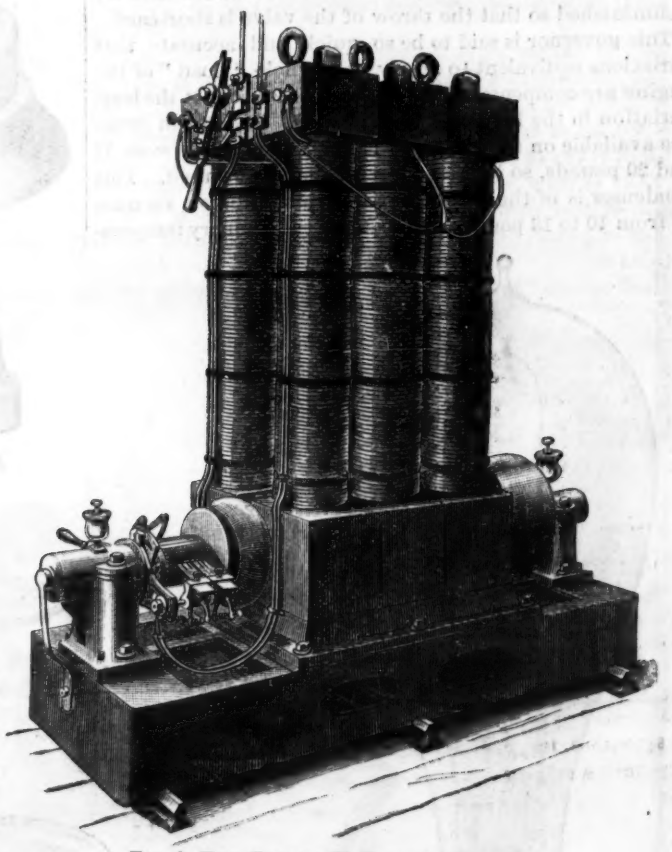

FIG. 3. THE EDISON K DYNAMO.

THE EDISON DYNAMO-ELECTRIC MACHINES.

governed is, besides, very simple indeed. It consists in regulating the throw of the slide valve by causing the eccentric moving it to vary in eccentricity. This is done by using two eccentrics. One is fastened to the crankshaft as usual. The other can move on the first, and the slide-valve is worked by the eccentricity of its periphery just as if it were directly attached to the shaft. It is movable, however, and under the control of the centrifugal force of two weighted levers carried by the fly-wheel, by which it can be caused to move around. Now, when the speed is below the normal rate to which the engine is adjusted, the outside eccentric moves over the inner eccentric so as to produce a greater total eccentricity, and the throw of the slide-valve is consequently lengthened. On the other hand, the moment the speed exceeds its normal rate, the second eccentric retreats and the total eccentricity is diminished so that the throw of the valve is shortened.

This governor is said to be so quick and accurate that variations equivalent to nearly the whole "load" of the engine are compensated for instantly, so that not the least variation in the light can be perceived. The steam pressure available on the Fanwood is low, varying between 12 and 20 pounds, so that a condenser has to be used. This condenser is of the Knowles pattern and affords a vacuum of from 10 to 13 pounds, sea water of the ordinary temperature being used for condensing. This makes a total available working pressure ranging between 20 and 40 pounds.

The engine is belted direct to the dynamo, the driving pulley being 40 inches in diameter, and the dynamo is driven by a 10-inch pulley at its normal speed of 1,200 revolutions. The electromotive force developed is controlled by the amount of resistance in the field magnet circuit of the machine. In this case the electromotive force is maintained at a standard of nearly 100 volts, and the current supplied to the external circuit has a volume of about 55 amperes. The current is taken from the terminals of the machine by conductors of No. 8 insulated copper wire incased in grooved moldings. This size of wire, which has an area of section of 16,510 circular mils, being found all sufficient to carry the current without danger of overheating. In the Pilgrim installation, it will be remembered, the conductors have a semi-lunar section, and are both inclosed in an iron pipe filled with an insulating compound, as shown in Fig. 5, which represents a short section of such a conductor. The area of section of the mains on the Pilgrim is nearly 500,000 circular mils. Wherever a large volume of current is to be conveyed this form of conductor—which is made of varying sizes—is always used, being preferable for many reasons; but when a comparatively small volume of current only is to be carried ordinary copper wire is used.

The mains from the dynamo give off two branches, which extend the whole length of the hold, one on each side, and which supply the lamps there. The general distribution above is effected from the "centre of illumination" as on the Pilgrim and all similar installations of the Edison system. The main lead divides into two branches which pass up to the midship house, one on each side, to a small "switch closet" situated above the engine shaft on either wall. At this point the conductor divides into five branches. Each branch is provided with a safety-catch and also with a special switch. Thus, if an accident happen on any one of the five branches the safety catch will automatically cut the circuit at this point or if in any case it becomes desirable to interrupt the current purposely in one part it may be done by means of the switch. Moreover as all the switches are collected together and conveniently located, the whole system is under the easy control of the engineer. The switch closet can be locked and thus all possibilities of willful or ignorant tampering are avoided. The safety catch, shown in Fig. 6, is an ingenious device by means of which a fusible strip is included in each conductor. The general arrangement of the Edison safety catch will be plainly seen from the figure. The screws serve to insure good contact with the conducting wires. The central cavity is lined with thin sheet brass, which is provided with a screw-thread into which a cap can be screwed. This brass "thimble" is connected with one of the strips of metal through which the connecting screws pass. At

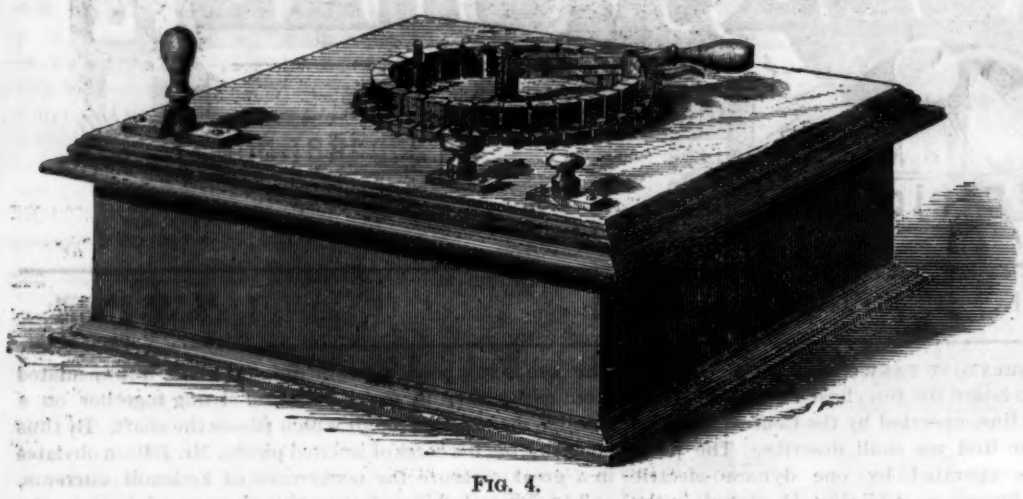

FIG. 4.

FIG. 5.

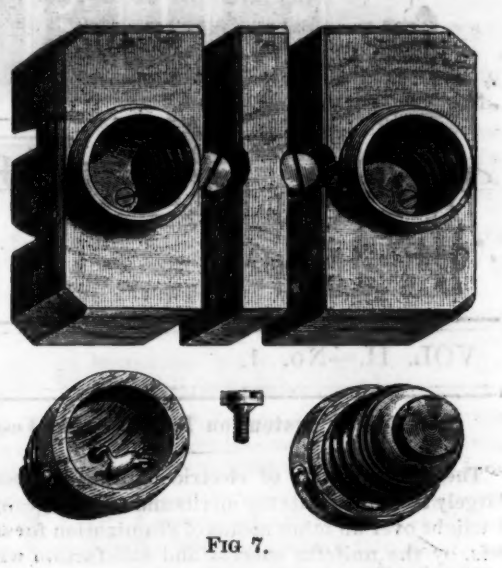

FIG 7.

FIG. 10.

FIG. 12.

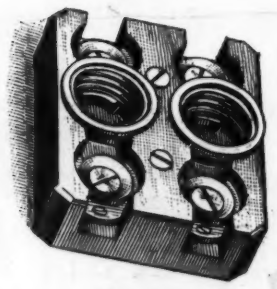

FIG. 6.

FIG. 13.

FIG. 9.

FIG. 8.

FIG. 11.

FIG. 14.

the bottom of the central cavity is a disc of thin brass which is connected with the strip leading to the other connecting screw. Now a short piece of fusible wire is soldered to this disc at one end and to the brass thimble at the other, thus completing the electrical connection. It will be seen that each side of the safety catch is independent of the other. Only one side may be used if desired, the other conductor being permitted to run aside without being cut, but this makes "assurance doubly sure," and is equivalent, in fact, to two safety catches. When the heat developed on that branch of the circuit becomes raised abnormally one of the two, or both, fusible strips will be fused, and thus open the circuit. An interesting and ingenious modification of this safety catch used on the Pilgrim and other boats may be conveniently described here. (Fig. 7.)

This form is intended for use at the points where two conductors are tapped by branches. It provides at the same time an easy and convenient manner of effecting the connection between the mains and the branches at the point of division or bifurcation. It will be seen that there are two double grooves in this case. The two vertical grooves in front receive one set of conductors and the two horizontal grooves (on the reverse side) the other set, the screws serving to secure them and at the same time to convey the current to the brass lining of the cavity with which they are in electrical connection. In this case it is not necessary to cut the main wires. From the bottom of each cavity extends a metallic strip to one of the horizontal grooves where a screw serves to fasten the branch conductor and at the same time to provide electrical connection. The connection between the sides and bottom of the cavity is effected in this case by a kind of cover which contains the fusible strip and which is represented separately at the lower part of the figure.

This cap screws into the cavity. To the inner surface of its metallic covering one end of the fusible wire is soldered, as seen in the left hand-view, the other end being soldered to a brass disc on the tip of the cap which touches the metallic strip at the bottom of the cavity when the cap is screwed down firmly, thus completing the electrical connection between the main and the branches. When the strips become fused, the caps are taken out and sent to the factory or to be repaired, and other caps may be put in their place. The switches used also constitute a most interesting device (Fig. 8). In order to give the reader an idea of its construction, we will refer to a larger size (Fig. 9), which is used on the Pilgrim and other boats, and which is shown with its brass covering partly removed. The two ends of the conductor are screwed to two pieces of metal *A B* by means of large, flat-headed screws. From each of these two pieces of metals, which are insulated from each other, two contact springs *a a*, *b b* project upward vertically. By depressing the knob or handle, in opposition to the spiral springs shown in the figure, the flat contact strip of copper *C* screwed to a block of insulating material, is lowered down so as to form an electrical communication between the springs *a* and *b*, thus closing the circuit. As the rod *O* is lowered, moreover, a catch is forced by a spring into the notch in the rod *O*, shown in the figure, and thus the switch is locked in the closed position.

The catch holding the rod *O* is controlled by a detent or trigger *M*. Therefore in order to open the switch it is only necessary to move this detent slightly. The moment the catch leaves the notch in the rod *O* the spiral springs force the switch up with a jump, thus breaking the contact between *a b* and *C* instantly. This rapid motion on breaking the circuit is of great importance, and it is for this purpose that the switch has been constructed in this way. When a branch conductor is carrying a current of large volume, say 50 or 75 ampères for instance, the vaporization or deflagration of the metal on rupturing the circuit is likely to cause the formation of an arc, which would still keep the circuit closed, while it would give rise to some danger. If, however, the rupture of the circuit is made very abrupt the arc does not have time to form.

The same design is used in different sizes. Thus, in some cases where the switch is intended to be adapted to a large main, the springs are so powerful that the rod has to be depressed by means of a lever, as shown in Fig. 10. On the other hand, the switch is used in smaller sizes for small branch conductors and for single lights (Figs. 11, 12).

From the "switch closets" on the Fanwood, the five branches pass upward and across the ceiling of the midship house on each side, where they divide into two sets, three branches going toward one end of the boat and two branches going the other way. Each branch supplies one of the chandeliers in the cabins, there being three chandeliers at one end of each cabin and two at the other, owing to the fact that the cabins are longer at one end of this boat than at the other.

The sixty lights are divided as follows:

Cabins, each 5 chandeliers of four lights	40
Midship house, engine space, 1 four-light chandelier	4
Midship deck	4
Pilot-houses, 1 over each	2
Hold	10
	60

The conductors supplying the current to the lights in front of the midship house at each end, and the branch which supplies the light over each pilot-house, first go to the pilot-house itself and pass through switches by which these lights may be controlled, so that if the light they cast forward interferes with the pilot's vision in a dark night, they may be put out temporarily.

The lamps (Figs. 13 and 14) are of the well-known Edison make, with elongated glass bulb and carbon filament, in the form of a U. As seen in Fig. 13, the joint between the lamp and its fixture is made in the same manner as in the double safety catch, having a screw cap (Fig. 7). The circular wall of the cavity of the fixture in which the lamp is screwed are connected with one wire and the bottom, which is insulated from it with the other. Likewise the metallic disc on the tip of the lamp butt is connected with one end of the carbon loop and the threaded portion with the other. Therefore the simple operation of screwing the lamp into the fixture suffices to form the connections. The design of the chandeliers is very unique and tasty. The installation is now complete, and the Fanwood began to resume its regular work a couple of days ago. It is scarcely necessary to add that the lights work well and give entire satisfaction. One feature on which we may take occasion to compliment those intrusted with the work is the particular care which was taken to keep out of sight as much as possible all suggestions of wiring. All who have seen beautiful ceilings spanned by ill-concealed wires will appreciate the neatness of the work and the care taken to conceal tracks.

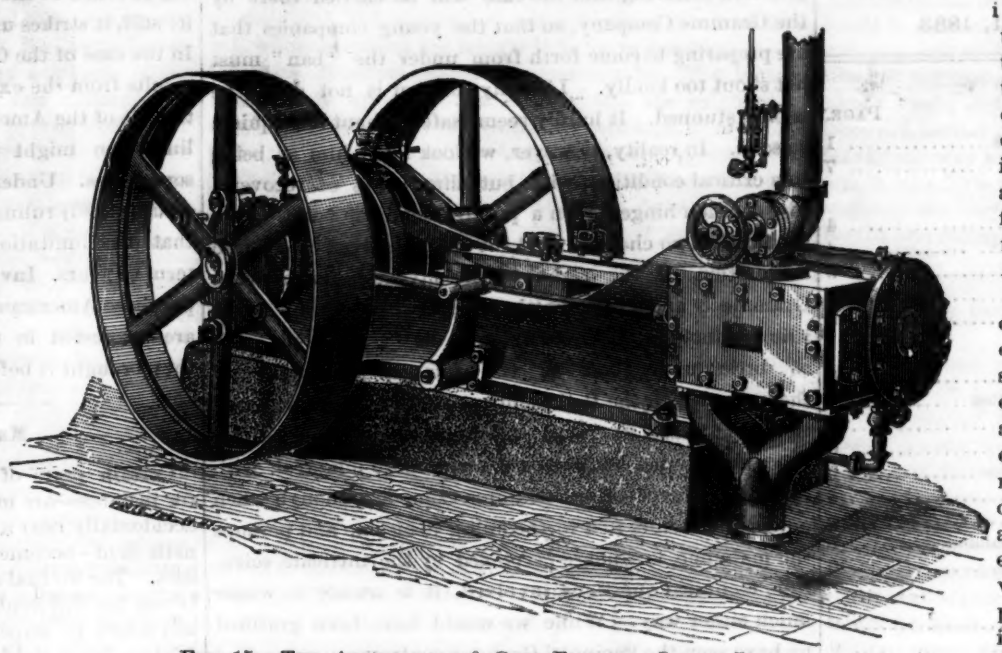

FIG. 15.—THE ARMINGTON & SIMS ELECTRIC LIGHT ENGINE.

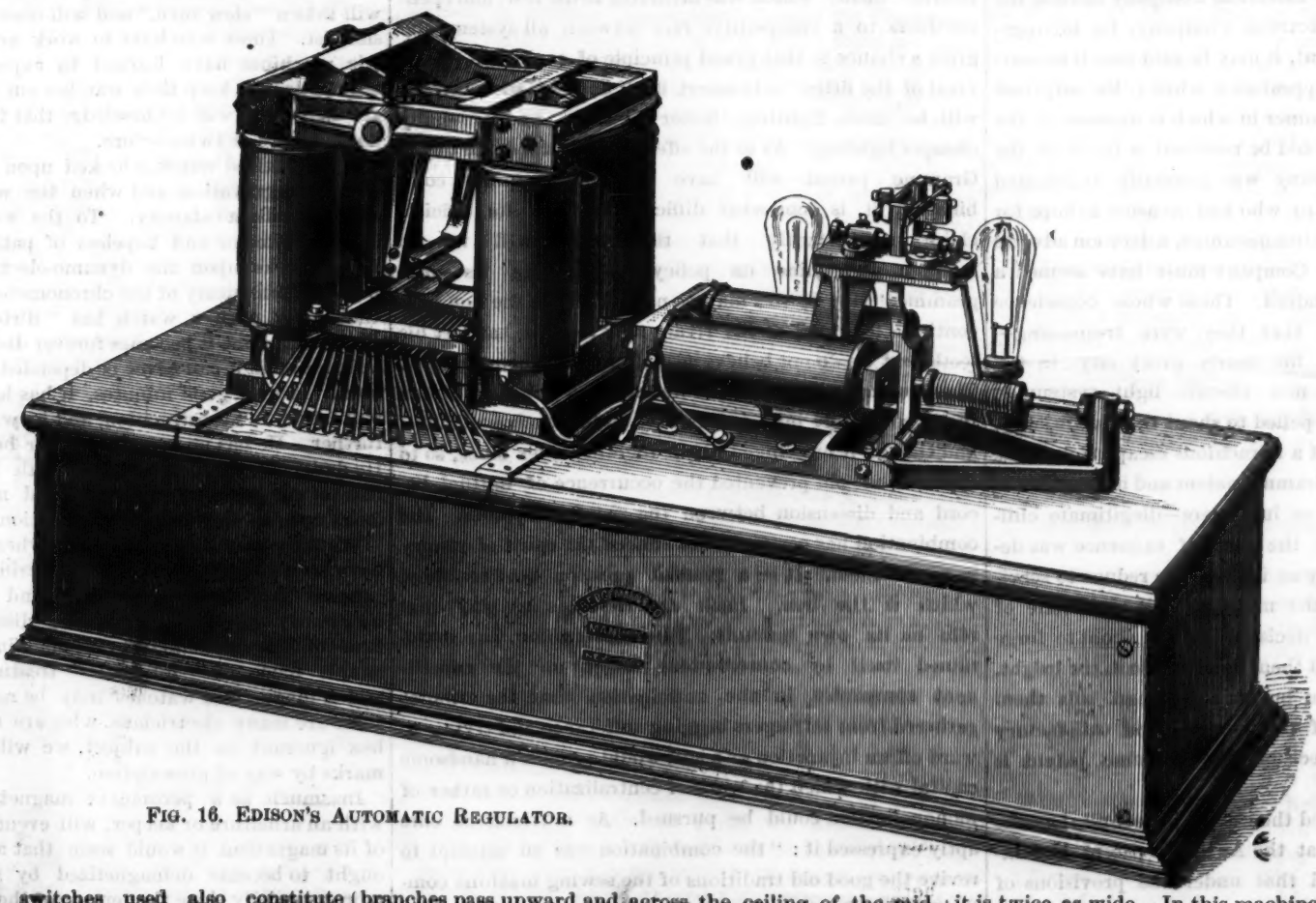

FIG. 16. EDISON'S AUTOMATIC REGULATOR.

THE U. S MAN-OF-WAR TRENTON.

The plant on this boat comprises one "L" dynamo (Fig. 2) and 250 lamps.

In this case a "C" Armington & Sims engine of the same type is used. This engine has a 9½ × 12 cylinder, occupies a space of 59 × 100 inches and weighs 4,500 pounds.

The steam is supplied from the main boilers at an average pressure of 60 lbs., and the engine is run at 280 revolutions. The pulley is 46¼ inches in diameter, with 8½ inch face, and is connected direct by an 8½ inch belt to the dynamo, both the engine and dynamo being placed on the berth deck near the centre of the vessel. The "L" dynamo is of the same general construction as the "Z," except that it is twice as wide. In this machine the magnetic field is composed of two "Z" magnets brought together, the armature being of the same diameter, only longer. In this case the armature has 54 sections and weighs 550 lbs., the total weight of the machine being 6,000 lbs. It occupies a floor space of 60×39 inches, and is a little over six feet high. The pulley on the armature shaft is 14 inches in diameter and has a 9-inch face. The "L" machines are run at a normal speed of 900 revolutions, which is the speed to be maintained on the Trenton. It will be remembered by our readers that one of these machines is used on the Pilgrim. The other two are the "K" (Fig. 3) type, which may be conveniently noticed here. The "K" dynamo is

Concluded on page 6.

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THE GRAMME DECISION.

Of the decision rendered by Judge Blatchford this week, in the suit of the Gramme Electrical Company against the Arnoux & Hochhausen Electrical Company, for infringement of the Gramme patent, it may be said that it has surprised many by its quick appearance, while it has surprised many more still by the manner in which it disposes of the case. That the verdict would be rendered in favor of the Gramme Electrical Company was generally anticipated and expected, even by many who had occasion to hope for the contrary. Under the circumstances, a decision adverse to the Gramme Electrical Company must have seemed a most agreeable surprise indeed. Those whose conscience had made them realize that they were trespassing—and they are numerous, for nearly every city in the Union can boast of a new electric light system in embryo—no doubt felt impelled to shout the hallelujah of exultant gratitude, as if at a miraculous escape from some imminent danger. The Gramme patent and its proprietors held them under the ban as infringers—illegitimate children, forsooth—to whom the right of existence was denied, and whom this suit was intended to reduce to servitude. But lo! just in the midst of this nightmare of anxiety, where a pending decision seemed about to forge the chains that would bind them hand and foot, the bright, rosy dawn of emancipation bursts forth, and bids them awake to a realization of the pleasing and satisfactory (to them) issue of the decision—the Gramme patent is dead!

Judge Blatchford decided the case on its technical merits altogether. He ruled that the Austrian patent had expired by Dec. 30, 1880, and that under the provisions of section 4,887 of the Revised Statutes the American patent had expired at that date also. Under the Austrian patent law, an inventor, for a small fee, can obtain a patent running one year. If the patent proves to be of value, he can renew it at the end of the year for any term within the fifteen years' life granted to Austrian patents. If the inventor fails to renew the patent fee from year to year, the patent lapses. This is what happened in the case of the Gramme Austrian patent. The patent was obtained in 1870 and the yearly fees were paid until 1880, after which they were not paid any longer, and consequently the patent expired. Attempts were made by the Gramme Company, it seems, to show that the Austrian patent was not a patent, but merely a "privilege" corresponding to a caveat here, or a provisional specification in England, but the decision shows that this view was not sustained sufficiently by the evidence presented.

The decision of Judge Blatchford is subject to an appeal to the United States Supreme Court, and we have no hesitation in believing that the case will be carried there by the Gramme Company, so that the young companies that are preparing to come forth from under the "ban" must not shout too loudly. Literally the lion is not dead; he is only stunned. It hardly seems safe to chant his requiem so soon. In reality, however, we look upon him as being in a critical condition, with but slim hopes of recovery. The decision hinged upon a purely technical point where the law left no choice. Had the case resolved itself into a question of the right to the invention as between Gramme and Pacinotti, which involves scientific principles as complete, as ambiguous and as little understood as the famous "undulatory" theme on which the Bell Company plays the syrenic variations that make its rivals sink into helplessness—"under the *waves*"—the result would seem more doubtful, with the odds in favor of the Gramme Company, though when one of the factors to a forthcoming decision, and perhaps the main one, is a judge perplexed by the intricate scientific, technical questions involved, it is unsafe to wager much either way. While we would have been gratified to have seen the Pacinotti-Gramme controversy comprised in the decision, we are glad on the whole that the question did not proceed that far. Judges are of necessity more at home with law than with technical science, and it is better perhaps not to let them go out of their sphere to decide on points about which learned scientists will themselves disagree.

We do not believe that the decision of Judge Blatchford is likely to be set aside by the Supreme Court, and in our opinion the Gramme patent is now virtually dead and the Gramme machine is public property, and everybody may make, use, or vend the same. So far as the effects on the electric light considered as an enterprise and as a scientific result are concerned, we believe that they will be most salutary. This decision simply throws aside the protective "tariff," which was favorable to the few, and opens the doors to a competitive race between all systems and gives a chance to that grand principle of evolution—"survival of the fittest"—to assert itself so that the outcome will be more lighting, better lighting, and especially cheaper lighting. As to the effects which the death of the Gramme patent will have on the Gramme combination it is somewhat difficult to tell. Its officials claim nonchalantly that this event will in no manner undermine its policy or derange its programme. May be so; may be not. Perhaps the lion may continue to growl at his rivals now that he has lost his teeth, but we do not believe its roar will put them to flight. The Gramme patent was the wand which originally called these companies into a defensive and offensive alliance, and though it has linked them together ever since, so to speak, it has not prevented the occurrence of mutual discord and dissension between the sister companies. The combination has certainly not effaced the spirit of rivalry in any of them. It is a mooted question between them which is the lion. Each one assumes to play that rôle on its own account. The organization has maintained itself by contributions levied on the constituent companies, in the anticipation that the tributes gathered from infringers begging sufferance and trying to ward off an injunction or a suit would provide a handsome capital with which the work of centralization or rather of monopolization could be pursued. As a friend of ours aptly expressed it: "the combination was an attempt to revive the good old traditions of the sewing machine combination." But the attempt has failed and could not do otherwise, because it was not as difficult as escaping through the eye of a needle to make a dynamo-electric machine escaping the Gramme machine. Failing the source of tribute or revenue, it is uncertain whether the contributing sisters will go down further in their pockets to support the cause.

However, while we rejoice to some extent over a circumstance which removes a powerful lever from a hand that would naturally use it for monopoly, we cannot help criticising the law by which it is brought about. The limitation of an American patent by the expiration of a foreign one seems to us to be unjust to a certain extent. It seems to us that a patent here ought to be guaranteed a certain period of life, independently of what transpires with the inventor and the invention in foreign countries. There is, of course, some abuse likely to occur in such a case. A man might await until the expiration of his patent in a remote country and then patent it here, and thus keep it out of reach of the public which is rightfully entitled to it; still, it strikes us that these cases could be provided for. In the case of the Gramme machine, the limitation which results from the expiration of the Austrian patent curtails the life of the American patent by about five years. This limitation might possibly be much greater, however, in some cases. Under the circumstances we believe that the clause (4,887) ruling this subject should contain a *proviso* that the limitation resulting shall not exceed a certain term of years. Inventors of all classes, and capitalists who purchase American patents of foreign inventors as well, are interested in this question, and it would be well if they brought it before the attention of our legislators.

Magnetism in Watches.

Certain parts of the works of a watch—the springs, for instance—are made of steel, and these, when brought accidentally near a magnet—that is to say, within a magnetic field—become magnetized and assume definite polarities. The mutual attraction or repulsion taking place between the different magnetized portions of the mechanism tends to impede the motion of the wheels, as if the friction were suddenly increased or as if the wheels were locked together. It is possible also that, when magnetized, the main spring may uncoil less readily and that the motive power is, therefore, weakened. Whatever may be the exact cause, the watch, when magnetized, runs very erratically and sluggishly, and loses time at the rate of one to several hours per day, or else it stops entirely. In some cases, in fact, the steel parts of the works are so well magnetized that the watch refuses to start when shaken in the well-known way. Although a strong magnet of any kind will "disable" a watch placed near it, dynamo-electric machines are accountable for the accident in nearly all cases. The field magnets of many dynamo-electric machines exert a magnetic influence over a considerable space around the machine, and, more especially, in front of the poles, and if a person carrying a watch happens to pass in this "magnetic zone," through thoughtlessness or carelessness, the probable consequences are that the watch will take a "slow turn," and will need to be put on the sick list. Those who have to work around dynamo-electric machines have learned by experience that the best way to do is to keep their watches out of range, and there are many who will acknowledge that they wish they had done so once or twice before.

A magnetized watch is looked upon by the owner as a piece of aggravation, and when the watch is a valuable one it recalls a calamity. To the watchmaker it is the most unwelcome and hopeless of patients. The watchmaker looks upon the dynamo-electric machine as the natural born enemy of the chronometer. It is his opinion that when once a watch has "flirted" with a dynamo-electric machine it becomes forever dishonest and unreliable, and that it can never be depended upon to "keep good hours" or even good minutes. It has lost its character and reputation, in his estimation, and he will not trust it any further. He has no remedy to offer but the melting pot. He dares not touch the works with his instruments for fear of magnetizing them, too, and magnetized tools he looks upon as forerunners of ruination.

We have known of many cases where valuable watches have been disposed of at a great sacrifice by their owners because they were magnetized and because there was apparently no remedy for the disease. But the dictum of the watchmaker is not final, for there is a simple mode of "magnetic" treatment by means of which magnetized watches may be readily cured. Since there are many electricians who are themselves more or less ignorant on the subject, we will venture a few remarks by way of prescription.

Inasmuch as a permanent magnet when unprovided with an armature or keeper, will eventually lose all trace of its magnetism, it would seem that a magnetized watch ought to become demagnetized by mere lapse of time, more especially since the temper of the pieces of steel used in the watch is comparatively low, in consequence of which the coercive force of the steel is small. Such is the case, as was proven in our own experience with a watch magnetized by a dynamo-electric machine.

After becoming magnetized it lost on an average about two hours per day. In this condition it was put away and remained unused for nearly two years. It was then taken out casually and was started for curiosity, when to our surprise it was found to have spontaneously regained its time-keeping qualities quite perfectly.

However, though it may be expedient to let time cure the time-piece, it is not always desirable, and in such cases a more active course must be pursued to cause the demagnetization. All that is required evidently is to subject th

watch to polarizing influences of an equal though opposed direction so that the polarities of the pieces of steel may be exactly neutralized. But in order to do this it would be necessary to ascertain not only the direction of the polarity of each piece of steel or magnetic metal, but also the intensity of the magnetism therein present. This would require instruments of precision and skillful measurements. But there is a simple method of procedure which arrives at the same result in a different way. It consists in subjecting the molecules of the steel to a constantly changing and diminishing polarity. If, for instance, we hold a watch in a given position near one pole of the magnets of a dynamo-electric machine, the molecules of the steel parts will become polarized in the direction of the lines of force, but if the watch is now moved so as to present another surface to the pole a new polarization takes place after the previous one is neutralized. Now it is well known that when a magnet has its polarity reversed many times in succession, the coercive power of the steel disappears, and the magnet cannot retain any polarity that is given it. But, however, if we were to remove the watch from near the pole while holding it one position, it is possible that the molecules of steel would retain this last polarity to a certain extent, so as to leave a "trace" of magnetism or "residual" magnetism. But if we recede from the pole while still turning the watch, then the polarity is absolutely neutralized at every point, and when the watch has left the magnetic field of the machine completely, it will be found completely free from any trace of magnetism.

There are several methods of imparting the rotary motion to the watch. An electrician, Mr. Hiram S. Maxim, has invented a special machine for the purpose. In this apparatus the watch is caused to rotate in an oblique plane, which is revolved itself on a vertical axis, while at the same time the watch makes a movement of gradual recession from one end of the frame where a powerful electromagnet is placed. By these combined and rapid movements it happens that every point of the watch is presented to the magnet at a changing angle during each revolution, and consequently every molecule of magnetic metal in it is subjected to all possible changes of polarity, and the demagnetization is perfect. It is not necessary, however, to make use of such complicated apparatus. We have ourselves demagnetized watches quite successfully by a much simpler procedure. We suspended the watch by a string which was then twisted so that it might cause the watch to rotate. While the watch was thus rotating, it was made to swing by a pendulum movement, and at the same time it was gradually brought near one pole piece of the dynamo-electric machine and then gradually moved away again. The operation was repeated a few times, and in the last the receding motion was made more gradual. We have known of cases where demagnetization has been accomplished by simply rotating the watch in the hand and walking toward and away from the dynamo-electric machine. But the result is more satisfactory when the rotary motion is rapid, and when the watch moves in every direction. To provide for a more ready change of the axis of rotation, we recommend the placing of the watch in a small bag that is suspended by a string. The position of the watch in the bag may then be shifted at pleasure. To show that watches can really be demagnetized satisfactorily by these methods, it is only necessary to state that in some cases the watches, after being demagnetized, kept absolute time within a variation of a few seconds per month.

Sal-Ammoniac for Gravity Cells.

There is much to be learned by studying our mistakes and mishaps. Indeed, it sometimes seems as if accidents and mistakes were but guides that make the observer deviate from the beaten path purposely, so he may stumble into a shorter and more direct route to progress. Some of the most important discoveries in our science were made through accident, and the suggestions which have led to many of the most valuable improvements in electrical arts have resulted from the analysis of mistakes. Many experiments which have been mistakes at the beginning, but which curiosity or a spirit of observation has allowed to proceed, have resulted in positive gains or benefits.

Mr. J. S. Witmer, of Suspension Bridge, N. Y., sends us an account of one of these suggestive and useful mistakes which will interest all, since it relates to something generally known and universally used—the gravity cell. Mr. Witmer relates the history and consequences of his "mistake" as follows:

"In April, 1881, I set up a battery of three cells gravity on closed circuit for a call-bell. Two months later I changed the bells to open circuit. At the end of six months the battery seemed weak, and, through mistake, about three ounces of sal-ammoniac were put into each cell. I supposed that they were spoiled, but, to my surprise, they worked more strongly than ever, and continued to work up to November 20, 1882, when the bells failed to respond; and even then, after having removed the cells and substituted others, I discovered that the fault was not in the batteries, but at the ground connection. How much longer they would have worked, had I not disturbed them, I am unable to say. But when I began to clean the batteries the whole thing—zincs, coppers, terminals and salts—all tumbled to pieces, until there was not much more left than of the 'Kilkenny cats.' These batteries were used more than twenty times a day during a period of over twenty months—fourteen months from the time of putting in sal-ammoniac—without the addition of anything but water."

The immediate improvement which followed the introduction of the sal ammoniac is possibly to be accounted for by the supposition that the internal resistance was diminished. Sal ammoniac, or ammonium chloride, is a salt whose solutions are not far inferior in conductivity to solutions of sodium chloride (common salt). The battery had been in operation six months and the sulphate of copper had become exhausted, as the attempt to replenish plainly shows. The sulphate of zinc, on the contrary, was probably abundant in the solution and constituted a deeper layer. The weakness of the sulphate of copper solution, and the thickness of the layer of sulphate of zinc solution, both combined to increase the resistance which the sal ammoniac tended to reduce. Possibly a double decomposition resulting in the formation of zinc chloride and sulphate of ammonia may have resulted, from which the resistance would have been likewise diminished. But the most strange part of the experiment is that the battery should have maintained itself in working order for fourteen months after the copper sulphate had been presumably exhausted. The reactions which took place in such a case must have been of a novel character and without doubt deserve to be studied by physicists. The sal ammoniac was probably electrolyzed. The chlorine in this case served to the formation of zinc chloride as in theLeclanché battery. The ammonia radical set free by the decomposition is not so easily disposed of, however. The reactions of a secondary nature to which it can give rise are very numerous, so much so that they are scarcely understood in the case of the Leclanché battery. The precipitation of a hydrated oxide of copper and its ultimate solution in the free ammonia (cupro-ammonium) is one of the special complications possible in this case.

It is not so much our object to attempt to clear the mystery as to call attention to it. The experiment of Mr. Witmer is valuable and seems to promise an improvement on the gravity cell. We hope that others will be induced to repeat this experiment and to study it carefully so as to determine precisely what and where the benefits are, if any there be. Even if we gained nothing more than a small diminution of internal resistance the results would be valuable.

Honest Technical Journalism.

In a recent issue we reviewed the varied expressions of dishonesty in technical journalism, showed the disadvantages and injury resulting from it to both publishers and readers, and pointed out that its assured fate, sooner or later, is ignominy, and probably, in most cases, the necessary cessation of publication, or, what is precisely the same thing, that conversion, in the shape of an entirely different policy, which implies "a new creature."

Regard to the essential dignity of a form of publication which seeks to inform its readers concerning the new and increasing discoveries of science and their multifarious applications to industry, suggests quite readily what are the proper characteristics of the honest journals published for these purposes. It is, of course, assumed that technical journals are published for the financial benefit of their proprietors. Journalism is not an expression of philanthropy, but either an experiment aiming at, or the established means to, commercial profit, and, in our judgment, the more clear and far-sighted is the business sagacity of publishers, the more likely it is that their productions will be characterized by sound, trustworthy and honest qualities.

The model technical paper presents information selected for its newness and inherent value, the proper guarantees of its acceptability to its presumably intelligent and discriminating readers. To this end the expenditure involved in its production is liberal, just as the wise farmer makes liberal preparation in order to insure the bounties of the harvest. Every means to assist the appreciation and instruction of the subscriber is provided by the use of scholarly and precise expression, which is the proper language of experts; and by the use of aids in the way of pictorial illustrations, these selected with the principal object of elucidating the matter of the letter-press, and if shrewdly with the view to make the journal more attractive, the better for both purchaser and publisher. At the same time, that is not a feature of honest technical journalism which loads otherwise commendable pages with pictures selected without regard to their value as instructors, but solely with the view to catch the eye and excite the curiosity, and thus increase sales. Were this catch-penny device altogether unknown, we would not name it; but as it exists, and as some publishers are weak and silly enough to pride themselves upon it, we do not hesitate to mention it. The success of technical journals is based upon the respect in which they are held by inquiring and well-informed persons, who give them steady patronage because of their substantial value as vehicles of information; and such readers as these are apt to be insulted by a policy on the part of publishers which underrates or mocks their intelligence. Again, all advertisements should be as carefully selected as the reading matter and illustrations. When admitted with due regard to their source and matter they are valuable as additions and auxiliaries to the other contents. Nor are readers slow to respond in the way of giving orders for goods, the announcements of which are not debased by improper association with advertisements taken without due inquiry and discrimination, and which may be depended upon. The publisher who selects advertisements with care and independence is rewarded by the certainty that his advertisers, finding their profit in patronizing him, will continue to do so, and their example will be followed by others who have for sale the class of articles an acquaintance with which is desirable to the reader and hence profitable to the advertiser and also, as a matter of course, to the publisher. To these observations may be added a regard to the refinement of the age in which we live. In its quality of paper, print and make-up the technical journal should be as good as the means and enterprise of its publishers can afford.

The Government and the Telegraph.

Among many of the absurd proposals dug up by great heads during the strike, was the demand for a government system of telegraphy separate from and running in opposition to the present system, and charging, as in the case of letters by mail, a minimum and uniform rate throughout the country.

We notice in a special dispatch dated Washington, Aug. 27, the statement that Postmaster-General Gresham is thinking over the recommendations inserted in his annual report, and is looking into the postal telegraph question. It seems probable, according to the correspondent, that he will recommend the establishment of a postal telegraph by the government in terms at least as strong as those employed last year by the late Postmaster-General Howe. Judge Gresham will be able to strengthen his recommendations with the facts of the late strike of the telegraph operators. He finds in his investigations that in the administration of Polk, when the telegraph was in its infancy, a government telegraph was contemplated by Postmaster-General Cave Johnson of Tennessee; that Atty.-Gen. Reverdy Johnson held, in the next administration, that, under the constitution, the United States had the power to regulate interstate telegraph traffic, as it had power to regulate interstate railway traffic, under the "commerce" clause, and that other statesmen have held, since the passage of the telegraph law of 1866, that the United States had the right to take any of the telegraph lines coming under its provisions at its actual appraised value. The postmaster-general will probably recommend that the government either buy a telegraph system at its actual value, or duplicate it at cost. He would take the patronage question out of consideration by appointing and directing the employés of the telegraph service on strictly civil service reform principles. He would give the employés tenure during good behavior, exacting of each an oath to faithfully perform the duties of the office, and above all else, to maintain inviolate the secrecy of the messages handled. He would annex severe penalties to violations of this oath.

Both THE ELECTRICAL WORLD and the *Operator* have been and are opposed to the government assuming control of the telegraph for reasons fully set forth from time to time. If the government take up the business at all it must make a monopoly of it. Otherwise the private concerns would cut loose from all the small, unprofitable places, and confine their service to the larger cities. They could thus get the bulk of the business and leave to the government the costly and unprofitable service with the mountain recesses and the backwoods.

Another Decision for the Bell Company.

At Boston, on the 25th ult., Judge Lowell ordered a decree for the complaint in the suit of the American Bell Telephone Company vs. Amos Dolbear *et al.* The opinion says that the final hearing in this case was hardly more than a matter of form, because the two questions which are raised by the record have been decided in favor of the plaintiff on motion for a preliminary injunction, which were prepared and argued with unusual thoroughness. These questions are whether the telephone described by Reis is the Bell telephone, and whether Dolbear's apparatus infringes Bell's patent. On the first point the judge says: "I decided, in American Bell Telephone Company vs. Spencer, 8 Federal Reports, page 509, that Reis had not described a telephone which anticipated Bell's invention, and the same has since been decided the same way in England in the case of the United Telephone Company vs. Harrison. It is admitted in the present case that the Reis instrument, if used as he intended to use it, can never serve as a speaking telephone, because the current of speech is constantly broken, and it is essential for the transmission of speech that the current should not be broken." On the second point the opinion is as follows: "At a former hearing before Mr. Justice Gray and myself, we decided that the defendant, Dolbear, whatever the merits of his telephone may be, employs a part, at least, of Bell's process, and that no additional evidence has been given at the final hearing, unless a further explanation of that already given may be called additional." An appeal will be taken by the respondents to the Supreme Court at Washington.

Concluded from page 3.

composed of three "Z" magnetic fields grouped into one. It is of the same height, and has the same size of armature, though longer still than that of the "L" dynamos. In this case the armature has 64 sections and weighs 650 lbs. The total weight of the machines is about 8,000 lbs., and it occupies a floor space of 39×70 inches. It employs the same size pulley as the "L" dynamo, and has the same normal speed of 900 revolutions. In the installation on the Pilgrim the two "K" and the "L" machines are all connected in parallel circuit to the same mains, and develop a uniform electromotive force of 108 volts, under which circuustances the "K" dynamos deliver a current of 235 ampères to a normal circuit, while the "L" delivers 138 ampères.

Two ways are provided of regulating the supply of current of the "L" dynamo on board the Trenton. One is by means of a hand regulator, as on the Fanwood, and the other by means of an automatic regulator like that used on the Pilgrim, though of smaller size. Each regulator may be introduced in the circuit at pleasure by a suitable switch specially provided for the purpose. The Edison automatic regulator is shown in Fig. 16. At the left-hand side are two electro-magnets whose poles are joined by a frame through which passes a rocking shaft. The armatures of the electro-magnets are supported by extensions from this shaft, from which a frame also extends downward between the magnets, that carries at its lower side a bent contact spring, which can slip over the contact segments, between which the regulating resistance is looped. It will be evident that when one magnet is energized the contact strip will move toward one end of the inverted circumference formed by these contact segments, and that when the other magnet is energized the motion will proceed in the other direction, so that by sending the current through one or the other of the magnets the resistance introduced in the field magnet circuit will increase or diminish according to the case. The relay magnet shown at the right is included in the main circuit, its armature, which oscillates between two contact points, being normally held back by a spring. When the proper amount of current is supplied to the circuit by the armature the relay counterbalances the springs sufficiently to keep the armature between the two contact points. If the currents weakens the armature is retracted by the spring and its extremity closes a circuit through one of the signal lamps shown, and through one of the magnets, and this magnet moves the rocking shaft until the resistance in the field circuit has been diminished sufficiently, after which the relay having resumed its normal power from the increase in the current, it attracts its armature and opens the local circuit. If, on the contrary, the current is too strong, the armature is attracted too far and closes a circuit through the other signal light and magnet, and the regulating contact is moved back, so as to introduce resistance in the field circuit.

The mechanism is very ingenious and its operation is very accurate and satisfactory.

The arrangement of conductors on the Trenton is most peculiar and interesting. The lights are all supplied by three distinct circuits which reach it by different routes. One of these circuits is the regular circuit, and is provided with switches and catches for each of the ten branches which radiate from a switch-board placed at about the centre of illumination. The other two are extra circuits, intended for use in emergencies. The Trenton being a man-of-war, the eventuality of naval conflicts had to be provided for. It might happen, for instance, that a cannon shot would tear away the conductors in one part of the ship, and this would leave the men in darkness, perhaps. By the insertion of a plug in the switch-board another working circuit is instantly provided, and a third may in like manner be brought into requisition if the second should also meet with destruction.

There are 250 lamps on the Trenton, while the capacity of the "L" dynamo is below 200 lights, but as a rule only a part of the lights are in use at a given time on board the Trenton, and thus the demand will not be likely to exceed the supply of current. The lights are divided as follows:

Gun deck: 1 between, 1 over each gun, gangway, admiral's cabin and staterooms	64
Main deck: 1 red and 1 green sailing lantern, 2 masthead lights	4
Berth deck	66
Orlop deck	55
Starboard gangway	6
Misscellaneous: storerooms, powder magazine, shaft alley, hold, engineer and firemen's rooms	55

The red and green and the masthead lights are each of 32 candle-power. The other lamps are of the "A" type of 10 and of 16 candles, having a resistance of 208 and 125 ohms respectively.

An interesting feature is the use of a guarded reflector for every lamp that is exposed to injury. The lamp is inclosed in a kind of lantern-shaped box, the back of which is composed of a semi-cylindrical reflector, and which is closed by a convex wicket door made of tinned iron rod one-eighth of an inch thick, which gives it strength enough to resist a powerful blow. This efficient and useful device is the design of Mr. J. H. Vail, Superintendent of the Edison Company for Isolated Lighting, under whose supervision the installations are made.

STEAMERS ALAMEDA AND MARAPOSA.

These two sister merchant and passenger steamers, lately built for the Oceanic Steamship Company, and which will ply between San Francisco and the Sandwich Islands, have both been fitted with identical installations of the Edison system. The installation consists in each case of 238 lights, for which the current is supplied by one "L" and one "Z" dynamo-electric machines, operated by a "B" Armington & Sims engine, making 320 revolutions per minute. The automatic regulator is not used, the variations of "load" being so slight that a hand regulator answers all practical purposes. The lamps are of the "A" type of 103 ohms and give 16 candles. They are divided as follows:

Dining Saloon	12
Passage-ways (stateroom deck)	10
Staterooms	100
Social Hall	9
Ladies' room and bath-room	4
Directors' room	5
Captain's "	3
Mate's "	2
Doctor's "	2
Engineer's, steward's, purser's rooms, barber-shop	6
Kitchen	3
Shaft alley	4
Engine-room	22
Coal-bunker	10
Boiler-room	4
Steerage	4
Hoisting and steering engines, etc	38
	238

The feature of special interest in these two installations is the arrangement of the stateroom lights. The lights are suspended from the ceiling of the berth and inclosed with a globular glass shade that gives a beautiful mellowness to the light. The conductors pass through a switch placed near the door before going up to the lamp. It will be seen that by this disposition the light is under the ready and convenient control of the occupant of the berth, while at the same time the lamp itself is so placed that it is out of reach of the occupant of the berth and less likely to accident, and besides it is disposed so as to shine to give the most satisfactory illumination.

STEAMER KINAU.

An installation of the Edison system is also being completed on board the steamship Kinau, a coasting trade vessel, plying between the Sandwich Islands. This installation is very interesting. It comprises 118 lamps, supplied by a new type of Edison machine, called the "100 Light dynamo," which differs from its sister types "K L Z" mainly in having a magnet field with cores shortened and somewhat further apart. It is run at 1,500 revolutions. The power is obtained from an "A" Armington & Sims engine with 6½ × 8 cylinder, and running at 350 revolutions. The hand regulator only is used to maintain the supply of current constant.

Two kinds of lamps of the "A" type of 208 and 103 ohms, and giving 10 and 16 candles respectively, are used. They are disposed as follows:

Engine and boiler rooms	15
Freight deck	25
Dining saloon	10
Social Hall	4
Staterooms	55
Kitchen	3
Captain's room	2
Director's "	2
Mail "	1
Hoisting engine	1
	118

The lamps in the staterooms are arranged in the same manner as those in the staterooms of the Alameda and Maraposa, above described. The steamer is intended to carry heavy freights and cattle, and in order to minimize all chances of accident the lamps on the freight deck are inclosed in guarded reflectors like those used on board the Trenton. Besides these, a powerful *search light* is also provided, because in some parts the coast is very shallow and the ships must remain at some distance, while it is convenient and sometimes indispensable to illuminate the coast from the ship.

The search light is of the arc type, and is run from the same machine that supplies the incandescent lamps, being connected in multiple circuit just like an incandescent lamp. The feat of running arc and incandescent lamps in parallel circuit together has always been considered extremely difficult if not impossible, hitherto, but we are informed that it is successfully accomplished in this case. The arc lamp is provided with a suitable reflector, by means of which its rays may be projected in any desired direction.

All of the above installations, including that on the Pilgrim, were made by the Edison Company for Isolated Lighting. We are indebted to the kindness of Superintendent J. H. Vail, for the information conveyed in the above details. The work of the Edison Company shows the results of the conscientious study of every condition, and the adoption of the best methods available to arrive at the desired effects, and it is supplemented by that careful attention to details which is certain to insure thoroughness and perfection in the results. We have so often seen good systems of electric lighting fail to give the results that could properly and justly be expected from them, just by careless unskilled engineering and manipulation, that we are glad to commend competency in this case. With a good system and carefully made installations like those just reviewed, the Edison Company is sure of a lucrative career.

The Failure of the New England Consolidation.

No person who reads carefully the account given in another place of the failure of the proposed consolidation of the New England telephone companies can attribute it to any other cause than that which appears on the surface, namely, the failure of the parties to agree as to the respective shares of the advantages to be derived from the union of their interests. The result of this disagreement in the particular case under consideration in no wise affects the truth of the general principles which underlie consolidation, of which we treated in an editorial article published in the last issue. Possibly, the failure of the New England telephone companies to consolidate, after the elaborate preparations which had been made for it, may check, temporarily, a tendency which, as we showed last week, is natural, and will certainly find expression.

Talking Through the Telephone.

"Our Critic," of the Lowell *Citizen*, expatiates on the above subject as follows:

The act of talking through a telephone—or at a telephone—is yet an accomplishment that few people understand, and one of the necessities of the hour is an instructor in telephone communication. A great many individuals are still possessed with the idea, that in order to be heard at the other end of the line, it is incumbent upon them to raise their voices to a camp-meeting pitch, and shout out their questions and answers as though they were talking through ten miles of solid fog; and there is an office not a thousand miles from this unhappy sanctum, where the poor, distracted telephone is shattered from stem to stern, and from the Blake transmitter below to the insulated conductors above, by the incessant and prodigious amount of bass, soprano, baritone and childish treble, which, in a key of high C, is being constantly poured into its battered and demoralized ears. That office does not need a telephone. All that is needed is simply to raise a window, and the whole town will hear what is wanted. But this is an abuse of the telephone, and not a proper and judicious use of this modern servant of mankind. An ordinary tone of conversation is all that is required. A harsh or loud voice destroys the harmony of the sound at the other end, and mars the current of communication.

British Telegraphic Service.

The experience of Great Britain is strongly urged in behalf of the embarkation of the United States in telegraphy. In 1870, the British government came into full possession of the telegraphic service of the country, and in 1874 it adopted a uniform rate of 1s., or 25 cents, for all messages under twenty words, combining addresses and signatures. The revenue and expenditures have increased as follows:

1873, revenue, £976,066; expenditures, £841,766; 1882, revenue, £1,616,799; expenditures, £1,366,000.

In 1879 the British telegraph service transmitted 23,385,000 messages; in the same year the Western Union handled 25,070,000 messages. The British service had at that time 6,600 offices, combining all the railway stations, while the Western Union had 8,534 offices. The Western Union in 1882 transmitted 39,000,000 messages and had 12,050 offices. The Western Union extends over more miles of line, that is, of distance from point to point, than the British service has miles of wires. The Western Union extends over 137,000 miles and has 347,000 miles of wires. The revenue of the British telegraph office in 1882 was $8,084,000; that of the Western Union, $17,114,000, or just about double.—*Age of Steel.*

Can Telegraph Tolls be Regulated by Congress?

Judge Lawrence, First Comptroller of the Treasury, in the course of conversation with the Washington correspondent of the Boston *Herald*, on August 27, said that he had no doubt of the power of Congress to regulate the tariff put upon the public by the Western Union Telegraph Company. He said that it was an outrage that this company, which was in law a common carrier, should be allowed to take property worth $15,000,000, water it to $80,000,000, and then tax the community to pay large dividends. The proposition that no man was entitled to more than he could earn was a false one, and very dangerous to promulgate in a country like this, where the chief peril lay in the possibility of communism as the population grew so dense as to make the struggle for life more close. Every man was entitled to what he could honestly gain, but not to benefits conferred by charter at the expense of the people beyond a legitimate amount. Congress had power given it to fix the rates on railroads, in the constitutional prerogative of regulating commerce between the States. The municipalities decreed what street railroads should charge and the tariff of the hack driver, and why should not the telegraph companies be dealt with in the same spirit? He would not dare to predict what would be done under existing conditions, but spoke confidently as to the powers of Congress in the premises.

If you don't want evil things said of you, don't do evil things. It is poor policy to grow feathers for your enemy's arrows.

Recent Improvements in Voltaic Batteries.

It is evident that the advent of the dynamo-electric machine and its wonderful progress as a generator of current have not entirely swerved the attention of scientists and inventors from other and older methods of producing currents. For a time the dynamo-electric machine seemed to be encroaching largely on the broad territory covered by the voltaic battery, and to many it seemed that it would eventually replace the latter in nearly every case. But there seems to have been a kind of reaction, and now the field of the voltaic battery is wider than ever, and its career most promising. Not only does it hold its own in every application where it has heretofore been useful, but it even promises to fill a new want. Between the dynamo-electric machine and the voltaic battery a gap exists which recent improvements in the latter are striving to fill.

Thus the voltaic battery is now being used quite extensively in operating small motors. Its use for electric lighting on a very small scale has been but a matter of experiment thus far, but there are those who speak of it as something that will soon be forthcoming. The result is that more interest is felt to-day than ever in the study of the voltaic battery, and the improvements are multiplying in a manner that promises to effect a solution of the problem.

We have been anxious to contribute to this important development by supplying readers of THE ELECTRICAL WORLD with every new detail of information bearing on the subject. The many letters which we receive from various parts of the country show that in doing this we are providing useful intelligence to a large class. We take pleasure, therefore, in giving extended space to some recent improvements in voltaic batteries, which we hope will be interesting to all our readers.

A new form of single liquid battery, possessing several features of merit, has lately been produced in France by MM. de Lalande and Chaperon. The elements of the battery are copper and zinc, and the exciting liquid is composed of water, containing 30 to 40 per cent. of caustic potash. With such a combination there is necessarily a tendency to the evolution of hydrogen at the copper plate in consequence of the decomposition of the water that furnishes oxygen to the zinc plate. The direct consequence of the presence of hydrogen on the copper plate is polarization, and thus the available electromotive force is reduced. In the Leclanché battery this tendency is provided against by a depolarizing mixture of manganese dioxide and pulverized carbon, the manganese furnishing oxygen which combines with the hydrogen evolved at the negative plate. MM. de Lalande and Chaperon have also provided a depolarizing agent, namely, oxide of copper, which is placed near the copper plate, and furnishes oxygen to the hydrogen evolved by electrolytic action.

Fig. 1 shows a simple form of this battery which recalls somewhat the gravity cell. At the bottom of the glass jar *V* is placed a sheet iron vessel *A* containing the oxide of copper *B*. An insulated wire *C* connected with this vessel constitutes the positive pole of the battery. The positive element consists of a large rod of zinc coiled into a spiral form *D* and suspended to the cover *E* and provided with a binding post *F*. A rubber tube *G* covers the upper portion of the zinc so as to prevent its being worn off at the level of the solution. It is evident, however, that the ordinary "crowfoot" zinc used so extensively in this country would answer equally well, the upper portion being suitably insulated by rubber tubing or melted paraffine.

To avoid the inconvenience of handling the potash the quantity of the substance in the solid state necessary for each cell is placed in the sheet iron vessel used to hold the oxide of copper and the vessel closed by a cover kept in place by an india rubber band. All that is necessary to set up the battery then is to open the vessel containing the potash and to place it on the bottom of the glass jar. The vessel is then filled with water and the oxide of copper in the form of a powder is thrown in and settles in the vessel. The inventors have imitated the Leclanché "prism" battery by forming prisms of their depolarizing oxide in various ways. The best method of doing this is to mix the oxide of copper with some oxychloride of magnesia in the form of paste, so as to form a thick mass that is then placed in metallic molds, where it "sets" in a short time, specially under the influence of heat. The amount of the magnesium current employed varies from 5 to 10 per cent., and the porosity of the "agglomerate" varies with the quantity used. Fig. 2 shows the "prism battery" of the inventors. The glass jar *V* is provided with a copper cover *E* screwing on the neck of the vessel like the cover of a preserve jar. This cover holds two vertical strips of sheet iron *A A'* against which the prisms *B B'* are held by india rubber bands. The positive binding post *C* is attached to the cover. The zinc is the same as used in the Leclanché battery and passes through the centre of the cover, it being kept from contact by a rubber tube *G*, the joints being made air-tight. The cover is also provided with another rubber tube *H* which is split, and forms a kind of valve. The vessel may be hermetically closed by means of a band of india rubber placed over the neck and cover at *K*. The potash used for the solution is either placed in the glass jar or in a separate sheet-iron box. The inventors also constructed a cell having only one prism, and which occupies a very small space. The use of vessels of malleable or cast iron or copper, which remain unaltered in the exciting liquid, permits the construction of cells having a large surface, and thus internal resistance is greatly reduced (Fig. 3). The shallow box *A*, about 40 × 20 × 10 centimetres, is made of sheet-iron brazed at the vertical edges, and answers the purpose of a receiving vessel at the same time that it forms the negative element of the battery, the positive binding post *C* being attached to it. The bottom is covered with a layer of copper oxide *B*, and porcelain insulators *L* are placed in the four corners. Upon these a plate of zinc *D* rests horizontally, its ends *D'* being turned up vertically but kept out of contact with the vessel *A*, which is filled three-quarters full with the potash solution. To the zinc is attached the negative binding post *M*. There is always some carbonic acid present in the air, and it is readily absorbed by the caustic potash gradually converting it into carbonate of potash. To avoid this undesirable reaction, the tendency to absorption of the carbonic acid by the large surface exposed to the air in this form of bat-

FIG. 1.

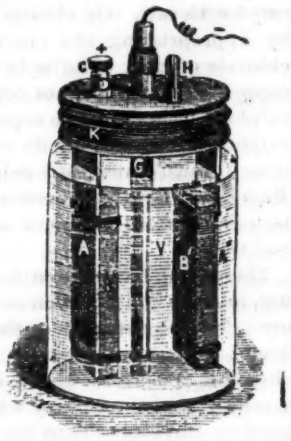


FIG. 2.

tery is prevented by pouring a thin layer of heavy petroleum, or else the battery is provided with a cover as in the previous forms.

The electromotive force of the batteries of MM. de Lalande and Chaperon is at first very nearly one volt, and its internal resistance is extremely low. With plates ten centimetres square (about four inches) placed five centimetres apart, the resistance would not be above ¼ or ⅓ ohm. The volume of current which they produce is considerable. The smaller types can give about two ampères in short circuit, and the large type can give easily from 15 to 20 ampères. Two of these cells give more current than one large size Bunsen cell.

These cells give a remarkably constant constant. The inventors state that with a depolarizing surface double the surface of zinc acted upon, the battery can work without appreciable polarization until it is almost completely exhausted. The reactions which take place in the solution as it becomes charged with zinc do not change the internal resistance materially. The great constancy of this battery is due principally to the gradual reduction of the oxide of copper to the metallic state, in which condition it is a better conductor. In this respect it contrasts with the Leclanché battery. The peroxide of manganese used as depolarizer in this battery is at first a better conductor than copper oxide, but by its reduction and transformation into lower oxides its resistance increases. It follows that the copper oxide battery can give a current of considerable volume in a circuit of low resistance while, as is well known, the Leclanché battery would become polarized rapidly under the same circumstances. The battery is entirely free from all local action, because the solution has no effect whatever of itself on amalgamated zinc and copper. The zinc is therefore consumed and the oxide deoxidized only while the battery is in use.

The energy contained in the oxide of copper and potash

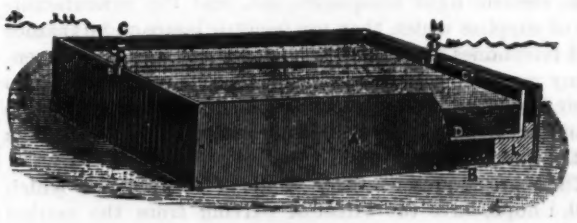


FIG. 3.

battery is much greater than that "stored" in an accumulator of the same weight, while the delivery is much slower and more easily controlled. The potash can be used in solutions concentrated to 30, 40 or 60 per cent. The solid potash can dissolve the oxide of zinc resulting from a quantity of zinc of over one-third its own weight. The quantity of copper oxide to be used is about one-fourth higher than the weight of zinc concerned in the reactions. These data enable the necessary constituents of the battery to be condensed into a relatively small space.

The oxide of copper batteries have given interesting results, as applied to the telephone. Indeed, the fact that it is exempt from polarization, while it presents all the merits of the Leclanché battery, would suggest it as useful in this application. For instance when the telephone is used to reproduce theatrical performances at a distance, it is necessary to provide four or five separate batteries of Leclanché cells, in order that the one in use may be replaced by another the instant it becomes polarized. A single series of the oxide of copper elements will suffice in such a case, because it is free from polarization. The inventors state that three cells were used night and day for working some Edison carbon button transmitters for more than three months without materially weakening. The cells can be worked for hundreds of hours on low resistance, and this efficiency can be obtained from them at any desired moment, for example, many months after they have been set up. The only precaution necessary in order to maintain them in order until they are exhausted is to protect the solution from the access of the carbonic acid of the air by a cover. Caustic soda may also be used for the battery instead of caustic potash. It has the advantage of being much cheaper, being readily obtained in commercial form under the name of "concentrated lye." It is likely, however, that the electromotive force obtained with this substance is a little lower, and the potash is otherwise much to be preferred, because it is less apt to give rise to the "climbing salts" which are so disagreeable.

When the oxide of copper battery is exhausted, it may be restored without difficulty. The copper oxide used is a product of all establishments where copper is worked. It comes off the surface of the copper in the form of scales, which have to be reduced again to the metallic state by a process of deoxidizing. The expense of the oxide must be very slight in those regions where it is to be had. But the exhausted oxide of the cell may be itself reoxidized quite easily. It will become spontaneously oxidized on exposure to damp air, or else it may be heated in an oxidizing flame. Another method is to charge the exhausted cell as if it were an "empty" accumulator, by which operation the various constituents of the cell are restored to their primitive condition. The copper now appropriates all the oxygen, while the oxide of zinc in solution gives up oxygen, and becomes metallic in the form of a spongy deposit. The zinc is not sufficiently coherent in such a case, and would need to be recast, unless it were deposited on a well amalgamated zinc plate, the mercury of which would cause it to cohere as it became deposited.

The battery presents interesting qualities, as a whole, and we should not be surprised to find it soon replacing the Leclanché and the gravity cells in many instances.

Some experiments with one of the cells of MM. de Lalande and Chaperon have just been made at the laboratory of the Industrial School of Physics and Chemistry at Paris, by M. E. Hospitalier. The results obtained give an excellent idea of the practical merits of this battery, and we reproduce M. Hospitalier's report from *L'Electricien* as being of great interest in this connection.

"The weight of the element was thus distributed:

	Grammes.
Glass jar	454
Sheet-iron box and conductor	41
Zinc and slate lid	419
Oxide of copper	200
Commercial solution of potash at 40 per cent	800
Total	1,914

"The battery, the initial electromotive force of which, one hour after being set up, gave 0.98 volts, was put in circuit for six whole days through a resistance of German silver wire of 0.8 ohms. The difference of potential at the terminals was measured by means of a graduated volt-meter of Sir W. Thomson. Thus the external resistance *R*, and the difference of potential at the extremities of this resistance being known, it is deduced from them the intensity of current, the quantity of electricity supplied, and the corresponding electrical energy.

"The current supplied was, on an average, half an ampère during six days, or 518,400 seconds. The total quantity of electricity supplied was 252,000 coulombs, the weight of zinc consumed 88 grammes, which corresponds to a theoretical production of 260,000 coulombs. This is a most important point, and very favorable to de Lalande and Chaperon's battery, for it shows that the local action is practically nil. The energy that the battery is capable of supplying is therefore available at will, without it being necessary to disturb the elements in order to withdraw the zinc from the liquid, as in the bichromate of potash batteries, for example. The useful, available rendering is 0.02 kilogrammetres per second. In six days, therefore, the battery supplied 10,368 kilogrammetres of available electrical energy. This exceeds the results obtained up to the present with accumulators of the same weight, but we must add that the supply is much slower than with these latter. It is however easy to increase this rendering by increasing the surface of the elements and by diminishing the distance of the oxide from the zinc plate. The result then increases more rapidly than the weight, and tends to approach that of the accumulators.

"The remarkable constancy of the rendering must be attributed chiefly to the fact that the product of the reduction is metallic copper, which is a good conductor, and that the solution of an alkaline salt of zinc which as formed presents a conductivity almost equal to that of the solution of potash. For a given weight of zinc dissolved, about three times the quantity of solid potash is required, and a quantity of oxide of copper, equal to 1.25 times the weight of the zinc. In our experiment the consumption of zinc being only 88 grammes, required in the reaction only 260 grammes of solid potash and 110 grammes of oxide of copper, *i. e.*, the battery was exhausted at about two-thirds only."

In the same number of our French contemporary, M. E

Reynier also contributes an article on this battery, discussing it mainly from the economic and commercial point of view. This article is also worthy of reproduction:

"The power and constancy of this battery, its great capacity for energy, and its absence of unpleasant smell seem to promise it several applications; it is therefore worth while to study it from a commercial point of view.

"The weight of each of the bodies assimilated or liberated by the reactions of the battery is obtained from the formula:

$$P = \frac{g}{E} \times n \times a \times 0{\cdot}0368 \text{ grammes, in which } E \text{ is the}$$

electromotive force of the couple in volts, a the chemical equivalent of the body, and n the number of equivalents in question.

"The reactions of de Lalande and Chaperon's battery take up 1 equivalent of zinc, 1 of potash (or soda), 1 of bioxide of copper, and liberate 1 of powdered copper.

"The values of $a \times 0.0368$ are:

Name of Substance.	Formula.	Chemical Equivalent.	Value of $a \times 0.0368$ grammes.
Zinc	Zn.	32.7	1.2
Potash	KO. HO.	56.1	2.06
Soda	NaO. HO.	40.0	1 47
Bioxide of Copper	CuO.	39.7	1.46
Copper	Cu.	31.8	1.17

'According to the experiments made at M. Hospitalier's laboratory at the School of Physics and Chemistry at Paris, the electromotive force varies a little. The six days' experiment described indicates a mean effective electromotive force of about 0.8 volts.

"With this value of E, the theoretical values of P, for a rendering of 3,600 kilogrammetres become:

	Grammes.
P, weight of the zinc	14.71
P, " " potash	25.26
P, " " soda	18.02
P, " " bioxide of copper	17.9
P, " " copper	14.34

"The impure potash of Croix (North) which the inventors employ is delivered at 70 centimes the kilo; the percentage of caustic alkali in this being only 0.9; the price of the potash is really 0.76 fr. : 0.9=0.78 fr. the kilo. As to the reduced copper, although it is inferior to that supplied by the Daniell batteries it may be estimated at 1.20 fr., as it can be utilized in the revivification of the bioxide.

"The theoretical cost price of 3,600 kilogrammetres would therefore be:

"For the potash battery—

	Francs.
Zinc 0.01471 K. at 0.6 fr.	0.0088
Potash 0.02526 K. at 0.78 fr.	0.0197
Bioxide of copper 0 0179 K. at 1.75 fr.	0.0313
Total	0.0598
"From which must be deducted:	
Copper 0.0143 K. at 1.20 fr.	0.0172
Remainder	0.0426
"And for the soda battery—	
Zinc	0.0088
Soda 0.018 K. at 0.54 fr.	0.0097
Bioxide of copper	0.0313
Total	0.0498
"From which must be deducted:	
Copper	0.0172
Remainder	0.0326

"The co-efficient of chemical utilization may be estimated at 1.5; by adopting here as elsewhere the value of 1.3 as co-efficient of physical utilization, we get:

"For the potash battery:

"Practical cost price of 3,600 effective kilogrammetres, 0.0426 fr. $\times$ 1.5 $\times$ 1.3 = 0.083 fr. Practical cost price of 1 horse-power per hour = 0.083 fr. $\times$ 75 = 6.22 fr.

"And for the soda battery:

"Practical cost price of 3,600 effective kilogrammetres = 0.0826 fr. $\times$ 1.5 $\times$ 1.3 = 0.063 fr.

"Practical cost price of one horse-power per hour =0.063 fr. $\times$ 75 = 4.72 fr.

"Thus de Lalande and Chaperon's couples, with soda, would necessitate an expenditure intermediate between those of the bichromate batteries and those of the sulphate of copper batteries, over which they possess the great advantage of expending hardly anything in open circuit.

"The inventors hope to lower the cost price considerably by putting into practice certain processes of regeneration. I myself formed, three years ago, similar plans for a battery which was certainly inferior to and not so simple as the one in question. I laid aside this branch of study as soon as I could see the practicability of the accumulators, which are batteries that can be regenerated without manipulation. Nevertheless, by collecting and utilizing their waste, M. M. de Lalande and Chaperon may succeed in lowering the commercial price of the materials consumed, so as to diminish considerably the expense of their primary battery, which possesses many advantages and has few faults."

An Italian scientist, Sig. Aurelio Mari, has also recently produced a new form of single liquid battery, which is of great interest, by the novel chemical reactions which it involves, as well as on account of its simplicity and cheapness. Zinc constitutes the positive element in this battery as in nearly all batteries. The positive element is composed of carbon covered with a compound mixture. It is prepared as follows: The ingredients of the compound in proper proportions, namely, sulphur 65 parts pulverized sulphate of copper 50 parts, powdered graphite or carbon 40 parts, are mixed in an iron vessel and heated. As soon as the sulphate of copper has lost its water of crystallization the sulphur melts, after which the mixture is poured into an iron mold, in the centre of which is a piece of carbon, which projects from the mold. When cold the mass is taken out of the mold, and the projecting part of the carbon rod is covered with a solution of paraffine in benzine so as to prevent the climbing of the sulphate of copper crystals.

The three different constituents of the agglomerate are intended for different purposes. The graphite is mainly to add conductivity to the mass, because the sulphur which cements the whole into a compact homogeneous mass is a poor conductor. The sulphur, moreover, takes an important part with the sulphate of copper in the chemical reactions involved.

To this carbon element is attached the binding post which serves to make the connections. The two elements are placed in a vessel containing water about half saturated with salt. On closing the circuit the zinc is dissolved by appropriating the chlorine from the salt and forms chloride of zinc. The soda of the salt then replaces the copper in the sulphate of copper of the mixture, forming sulphate of soda. The copper set free combines with the sulphur forming sulphide of copper, which gradually becomes transformed into sulphate of copper under the influence of the atmospheric air held in the water. The action is therefore produced at the expense of the sulphur and the air.

There is no local action in this battery when it is not in use, and the consumption of material is very small during use. The agglomerate substance only dissolves in sufficient amounts to supply the elements necessary to the chemical reactions above described. It is said by the inventor that the battery will last for over a year without needing any more than the occasional addition of a little water to replace that lost by evaporation. When the battery is finally exhausted, the remaining spongy mass of graphite, with some proportion of sulphate of copper, may be washed with dilute acid and used for making a new agglomerate.

The battery works very well on closed circuits of high resistance. When the resistance is too low it polarizes slightly, but recovers itself rapidly when permitted to rest. It is especially adapted to intermittent work like bells, annunciators etc. It seems also to be well adapted to telephonic purposes as a cheap substitute for the Leclanché battery.

Competition in the Electrical Business.

BY THOS. C. FRENYEAR.

It is pretty well established that the middleman is a very useful factor in the business world. This is an age of concentration. Manufacturing is carried on more after the "one idea" principle than ever before. Without the middleman the consumer would be obliged to buy at many places what he now obtains at a single one. A jobber's store reminds me of a dish of hash—the different ingredients have been secured from various places, mixed together, and then the mixture is ready for delivery to the numerous consumers. A great advantage accrues to the manufacturers also from the existence of middlemen. Their circle of customers is much smaller and of a deal better class as regards amount of trade and financial soundness than they would have by selling to consumers direct. It will be observed that by consumers I mean those who put up or apply electrical apparatus, and not necessarily the ultimate consumers or users.

The electrical business can hardly be said to have reached that stage of progress where it can claim stability. Electric lighting is a pronounced success, telephony is a business necessity, certain domestic applications of electricity are almost universally used, but between electricians, electric light companies, etc., and the manufacturers of supplies which they use (electric lamps and dynamos and telephones of course excepted) stand the middlemen. Many manufacturers are jobbers of goods which are not in their line of manufacture, and there are some who do no manufacturing whatever, relying entirely upon the profits of the jobbing trade.

There are at present three kinds of competition which will, I hope, have the effect of driving from the market weak and unreliable concerns. There is competition between manufacturers in certain goods, patented and not patented, which require in their manufacture no expensive machinery and not especially skilled labor. This competition cannot but be attended with good results to the business public and the public in general, though effecting this result at the expense of a few parties who have seen fit to deluge the market with second-class goods.

Then there is competition between manufacturer and jobber. The state of affairs of which this is a symptom is certainly deplorable. Sometimes the cutting is the fault of the manufacturer, sometimes of the jobber. We will suppose, for instance, that a jobber obtains the agency for a certain line of goods, and the manufacturer offers the same goods to his customers at so low a price that the jobber cannot make a fair profit. It is damaging to both parties—to the manufacturer, because the jobber can reach some trade that he cannot; to the jobber the damage is very apparent. Manufacturers should protect their agents by sustaining the prices of their goods, and would find it to their own interest so to do and to allow a fair margin to the jobber. In these days it is personal contact combined with judicious advertising that obtains trade, and hence manufacturers make a great mistake in trying to handle business direct which would be much more carefully and vigorously pushed if relegated to responsible agents in the great trade centres.

But the most abnormal competition at present is between middlemen on staple goods, which, notwithstanding the cutting of prices, yield the manufacturers a handsome profit because they keep the prices up. It is amusing to listen to the criminations and recriminations of each jobber against some one or all the rest. A says that B is cutting prices, B says that C is selling goods for less than cost, *i. e.*, if he pays his bills, and C says that A has "knocked the bottom out of the market;" and the saddest if not the most amusing of it all is, that probably they all tell the truth. But we think no one in his sober moments would accuse any one of being the *only one* who is cutting prices. They all do it, and everybody knows it. In the jewelry business, if a new man comes in and cuts prices, the old, stable concerns join together and run him out of the market; but in the electrical business it is yet somewhat of a question as to who is going to be run out, and more of a question as to who are going to join in and run him out.

There must be some limit to this course of things. It is not likely we shall any more than touch bottom. In the last few weeks prices of everything, from butter to Wall street stocks, have been at their lowest. Recovery must be gradual, but the slower it is the more surely will it remain. We have reason to expect that the business of the country will be prosperous and remunerative, and very largely from surplus earnings comes the lucre that flows into and often through the pockets of electrical traders. There is business enough for all, and if every one will be generous enough to desire only his share, and that not a lion's share, the cutting of prices will soon cease, and the competition will result only in keeping the prices at a scale equitable to all—manufacturer, dealer and consumer.

The Vienna Electrical Exposition.

The Vienna Electrical Exposition, the opening of which on the 16th ult. we chronicled at the time, is said to be the greatest exhibit of the kind held up to the present date. Thirteen nations are represented in the magnificent display of electrical appliances there on exhibition, and visited by enormous crowds. The hope is entertained that many of the exhibits will be sent to this country for the exposition to be made at Philadelphia in October, 1884. Measures have been taken to secure this desirable result, and it is announced that the contents of the French department will be shipped to this country upon the close of the exposition of Vienna. Should the English and German exhibits be also forwarded, as is hoped, the probability is that the coming Philadelphia exhibition will be little if at all inferior to that now open.

Vienna is a city remarkably interesting and well adapted to its present purpose. With its ample hotel accommodations and other facilities for the comfort and entertainment of travelers, its citizens are reaping a rich harvest from the numerous visitors, more or less distinguished or not distinguished, citizens of all the leading nations of the world, who have there congregated for the purpose of seeing the exhibition and acquainting themselves with the numerous sights of beauty and historic interest with which Vienna and its neighborhood abound.

The building in which the exposition is held is described by the Vienna correspondent of the London *Telegraph* as much better adapted to the purpose than either the Crystal Palace, near London, or the Palais d'Industrie, Paris, scenes of earlier ones. It covers an area of 33,000 square metres, or 4,000 more than the latter. Its immense height and peculiar shape could not have been better adapted to the purpose had the Rotunda been built for this special occasion. Passing through the entrance portal, the visitor enters a large vestibule leading directly to the central hall. This is covered by a lofty cupola, surmounted by the imperial crown, and visible for many miles in every direction. The centre of this cupola is 66 metres from the ground. The sides slope all round, and meet a succession of fine colonnades, by which the hall is surrounded. One circular gallery runs round the top of these pillars, and a second one is situated midway between them and the cupola, while a third is built round the cupola itself. At night these are one blaze of electric light, which renders the illumination of the hall dazzling beyond description. In the centre is a cascade fountain, surrounded by beds of exotic plants. Six large Jablochkoff lights illuminate its waters from beneath. In front of the entrance vestibule is a large platform, erected for the Emperor during the opening ceremony. From the colonnade surrounding the hall three large vestibules open directly into the spacious galleries, which bound the main building on the west, north and east sides. The last mentioned of these is devoted to a theatre and dwelling-house, lighted exclusively by electricity. The theatre, quite a little bijou, is most tastefully fitted up, and can accommodate some 300 spectators. It is lighted up by 1,500 or 1,600 incandescent lamps, those on the stage being arranged to produce changes of color. They are to be fed by a dynamo machine placed in a neighboring hall, the amount of power

needed—according to the number and strength of the lights—being regulated by a very ingenious automatic apparatus. The north and west galleries are transformed into machinery halls. A gigantic chimney, containing 700 cubic metres of brick masonry, stands outside, adjacent to a shed protecting no less than 14 boilers. The engines used to drive the dynamo machines are of 1,200 horse-power. In front of the main entrance are two high masts, from the top of which five powerful arc lamps illuminate the woods of the Prater. This is a system similar to that employed in many American cities for lighting streets and squares. Ten lamps with strong reflectors transform into a luminous crown the gallery surrounding the top of the roof. Powerful locomotive lamps light up the various avenues leading to the Rotunda. The Vienna firm of Siemens & Halske have constructed an electrical railway, which, for a small charge, transports visitors from the entrance of the Prater to the exhibition building.

The New England Consolidation Scheme Abandoned.

The proposed consolidation of the New England telephone companies has been abandoned. In Lowell, particularly, arose the potent force which put an end to the proposed arrangement, and we accordingly begin our account of the failure with an ominous paragraph published in a journal of that city:

The Lowell *Mail* of the 23d ult. said: "The fall in prices of the stock of the telephone companies of New England since the vote to consolidate was passed, and the delay in organizing the new company, have caused serious uneasiness among the stockholders, and rumors are current that a break will occur, and the companies will continue under the present management. This would certainly insure the continued success of the Lowell enterprise, while under the proposed régime and ironclad contract with the American Bell Company, serious obligations, etc., success might not be so flattering as heretofore. It is generally understood that, in the event of consolidation, the present active officers of the Lowell Syndicate would hold minor positions in the new company. This fact is also attributed as a part of the cause of the existing uneasiness. During the past few weeks the New England stock has depreciated from 25 to 30 per share, while the Erie company has remained firm at 60 and 63. Unless there is a sudden rise in the stock to be a part of the consolidation, we are assured by large stockholders that the executive committee will be requested not to consummate the transaction at present, and, in case of such action, consolidation will practically be abandoned, as the Lowell companies constitute all but two of those to make up the proposed combination."

The above paragraph foreshadowed the events of the next few days. On the 25th of August, the telephone managers met in Boston and discussed the proposed consolidation. A result of the conference was the postponement of the scheme of consolidation, a step taken out of consideration for the strong feeling against it which had been manifested by stockholders in Lowell and elsewhere. Three days later, the announcement was made that the scheme was a failure. This result is attributed to the fact that, under the terms proposed, the American Bell Company, in the opinion of numerous stockholders, would have a disproportionately large share of the advantages to be derived from the proposed union. As shown in the figures published in this paper two weeks ago, the New England companies had a united capital of $16,000,000, of which the American Bell Company was to take one-half at the outset, and then $1,000,000 of the remaining $8,000,000 as a construction fund. This would have left the consolidated companies but $7,000,000 with which to complete their plant, and of this the American Bell Company reserves the right to take one-half, or, at least, one-half of all the new issues of stock. Added to this cause of discontent was the decline in stocks of the individual companies, consequent upon the report that they were about to consolidate. The present situation is, that the companies are proceeding about their individual business as if consolidation had never been thought of, and there seems to be no possibilty that it will ever take place.

New Edition of Gordon's Electricity and Magnetism.

A second edition of this important and elaborate work has just been issued. The first edition has been mentioned in these columns and in our Pamphlet of Electrical Books, and its many valuable features pointed out. The following regarding the new edition, which we copy from the London *Electrician*, will be interesting to American electricians:

"The author, being familiar with the details and results of the extended experimental work of recent years, and seeing the bearing of these results upon electrical science, also the great difficulties in the way of students obtaining a knowledge of these investigations, determined to facilitate the work of students by giving a work which has as a principal feature the discussion of these experiments. The result is an excellent treatise, far better illustrated than any other work we know treating of electrical subjects in the English or any other language. This edition has been partially rewritten, rearranged and extended. The principal extensions relate to the experiments of Tribe, Bjerkness, Stroh, De la Rue, Becquerel, etc. These new chapters are beautifully illustrated, especially that upon Mr. Tribe's electrolytic experiments, where 'facsimiles of the beautiful copper deposits on silver plates' are given. * * * A book which every one emulous of the name of an electrician should possess. In it will be found information that can only be obtained by considerable trouble and searching through volumes of *Proceedings*, and even when a particular paper is found in the *Proceedings*, its position in the 'links' of research can never be so well ascertained as when found in the connected narrative given by Mr. Gordon in this Treatise on Electricity and Magnetism."

There are few books that can be so warmly recommended to the student of electrical science as this one of Mr. Gordon. It is published in two large volumes, and is undoubtedly the best and most complete work on the subject published. The book can be had in this country, and—as in the case of any other electrical work—is for sale at this office. The price, including mail or express charges, is $7 for the two volumes.

Effect of the Incandescent Light on the Eyes.

The *Medical Record* says on this important subject:

"In discussing the value of any particular source of artificial light, says Professor Mauthner, three qualities should be especially regarded: 1, steadiness of light; 2, the strength of the light; 3, its composition. From its complete failure in point of steadiness, the arc light must be at once rejected from the category of lights suitable for the human eye. The incandescent lamp, on the other hand, deserves a prominent position. As regards its strength or intensity, it also fulfills all requirements, since it can be modified or intensified at will. The composition of the lights habitually used hitherto has shown a preponderance of yellow rays. In the electric light, however, the short-wave rays predominate, *i. e.*, the violet rays. To the human retina, blue or violet tints are more agreeable than yellow, and hence from its composition, as well as from its steadiness and adaptability, the light of the incandescent lamp is especially adapted for the use of the human eye. Distinctness of vision and the perception of color are both increased under the electric light, facts which might be theoretically held to involve an overstrained retina. Such a theory is not, however, borne out by practical experience; it is only where the light employed is unsteady that any ill effects have been observed. It may be considered as an established axiom, that the brilliancy and composition of any light are as nothing, in respect of its value as an illuminating medium for ordinary uses, compared with its constancy and steadiness. In the incandescent lamp no combustion takes place, and hence no consumption or vitiation of atmospheric air is induced. From a theoretic point of view, therefore, no objection can be raised against the use of the incandescent electric lamp."

THE TELEGRAPH.

BACK TO THE OLD FIGURES.—The operators of the American Rapid Company are being paid the same wages they were previous to the strike. Their resumption of work during the strike was accompanied by the agreement that if the strike was a success they would receive the advance conceded by the Western Union Telegraph Company. The strike being a failure, the old rates of pay are continued.

RUMORS OF A CONSOLIDATION.—It was reported in Philadelphia on Thursday that a consolidation had been effected between the Pottsville & Reading and the Baltimore & Ohio Telegraph Companies. The Reading has an arrangement with the Western Union that will not expire for more than two years. The report was discredited by officers of the companies, who said that they had heard nothing about the matter, further than the talk upon the street.

THE POSTAL TELEGRAPH COMPANY.—The mill belonging to this company, situated at Ansonia, Ct., is being worked to its fullest capacity and its extension is proposed. The company is reported to be trying to make arrangements with the government for permission to use as a postal card a fac simile of that issued by the United States. It will not be of paper but of a material the composition of which is known only to the inventor. These cards will be sold for twenty-five cents each, and they are to combine the advantages of the postal and telegraphic systems of communication.

PRESIDENCY OF THE POSTAL COMPANY.—Mr. John W. Mackey, the California millionaire, has taken the presidency of the Postal Telegraph Company. At first he declined the position, but reconsidered his determination. Besides being the chief officer, he is, as custodian of a majority of the capital stock, the controlling spirit. Mr. Mackey said on Tuesday that the policy of the company would be unchanged. The work of extending the lines would be prosecuted as rapidly as possible. By Mr. Mackey's acceptance of the presidency the only vacancy in the list of officers is filled.

EXTENDING THE POSTAL COMPANY'S LINES.—Contracts to the amount of $1,500,000 for the construction of new lines have been awarded by the Board of Trustees of the Postal Telegraph Company. Lines of two wires each will be put up from New York to Washington, New York to Boston, Buffalo to Pittsburgh, Fostoria, Ohio, to Toledo, and Chicago to St. Louis. Two wires will be added to the wires already strung between New York and Chicago. The lines are to be completed, according to the terms of the contracts, by January 1. It is claimed that the capacity of the copper wires now up between New York and Chicago is equal to twenty iron wires, and will be doubled by the additional two. John W. Mackey, the president, will leave New York for California in a few days, but he will see the work fairly under way before he leaves. The contractors begin at once.

TWO CHANGES IN PHILADELPHIA.—Mr. C. Latta Laverty has been discharged from the Associated Press Office at Philadelphia. We have not heard that any reason was given for his removal, except that he was Master Workman of the Assembly there during the strike. Mr. Laverty is an operator of rare skill, and his devotion to the cause of his fellow workmen, and the administrative qualities displayed by him in managing that large assembly, cannot long go unrecognized and unrewarded. Mr. William A. Connor, of Chicago, will succeed Mr. Laverty. Prior to the strike Mr. Connor was one of the chiefs in the Western Union at Philadelphia, and his "resignation" and immediate appearance at the Brotherhood's rooms gave a great impetus to the strike there. He was of course tabooed when the men went back, and we are glad now to see his pluck and ability recognized in another quarter.

THE TELEPHONE.

A TELEPHONE has been placed in Balmoral Castle, Queen Victoria's home while in Scotland.

INCORPORATED.—The Cincinnati Overland Telephone Company of Cincinnati; capital, $300,000.

"BELL-O."—A contemporary remarks that the use of the word "hello" has quadrupled since the introduction of the telephone and suggests that "bell-o" would be more appropriate.

ACCIDENT TO A LINEMAN.—Henry McDonald, employed by the Suburban Telephone Company, fell from a pole in Malden, Mass., on August 23, and fractured his right arm and sustained injuries to his back. He was taken to the Massachusetts General Hospital.

PERSONAL.—Mr. E. T. Gilliland has returned from Europe. Mr. Frank B. Knight, special agent for the Bell Company, has been East for the past week. Traveling through the West does not seem to pull him down much in flesh, though he says such a life gets a little monotonous after a while, and is not very desirable.

TELEPHONIC COMMUNICATION BETWEEN MOVING VESSELS.—The telephone has been successfully used in France to communicate between a vessel being towed and one towing. The wire was carried along one of the hawsers, and the circuit was completed through the copper on the bottom of the ships and the water. Conversation was carried on distinctly.

CUTTING THE WIRES AT LONG BRANCH.—Communication by telephone between Long Branch and Eatontown and Red Bank was broken on Tuesday by reason of the wires being cut. The report is that this was done by Edward Clark, owner of the poles supporting them, whose alleged grievance was that the New York and New Jersey Telephone Company had used his poles without authority, and had afterward failed to arrange for payment for their use.

THE TELEPHONE IN BUENOS AYRES.—There are more than one thousand subscribers to the United Telephone Company of the River Plate, the administration and central offices of which, situated in the city of Buenos Ayres, constitute a fine building fifty feet front and two hundred feet depth. In addition to its telephonic service, the company has a messenger service. Since the 10th of April, when the company began operations in Buenos Ayres, it is reported by the *Standard* of that city to have doubled in paying subscribers the combined lists of the old Pau and Bell companies, from which it was formed.

THE ELECTRIC LIGHT.

A COMPANY FOR PEORIA, ILL.—The Jenney Electric Light and Power Company, of Peoria, Ill., was incorporated last week; capital stock, $25,00 0. Incorporators—Joseph P. Smith, Ezra Weis, Wm. Bowen, Martin Kingman and F. H. Cooper.

THE EDISON LIGHT IN ITALY.—The Italian Edison Company has purchased the Santa Radegonda Theatre at Milan for its central station, from which it runs 3,500 lamps. The famous theatre Della Scala will be lighted the coming season with 2,000 lamps.

SUCCESSFUL LIGHTING OF A HOTEL.—The Sagamore Hotel, on Green Island, Lake George, is lighted with 369 incandescent lamps, of which 172 are in the sleeping-rooms, 33 in the dining-room, and the rest in the halls, parlors, billiard-room, offices, and other departments of the house.

THE ELECTRIC LIGHT AT THE ANTIPODES.—The electric light is making rapid strides in the antipdes. The gov-

ernment offices at Wellington, New Zealand, the Victoria House of Assembly at Melbourne, Australia, and the Parliamentary buildings and government offices at Brisbane, Queensland, are all lighted with incandescent lamps.

LIGHTING THE HOUSE OF PARLIAMENT IN MELBOURNE.—In the House of Parliament, Melbourne, the Australasian Company have recently replaced 78 gas jets by 70 Lane-Fox incandescent lamps. The dynamo in use is the new Brush incandescent 100-lighter. A Ferranti 250-lighter has also been erected by the same company and is kept in reserve. Perfect satisfaction at the change is expressed.

ELECTRIC LIGHT IN GOVERNMENT SHIPS.—The United States steamship Trenton, now at the Brooklyn Navy Yard, is receiving a plant of 150 Edison incandescent lamps, and the United States Fish Commissioner's steamer Albatross has had a similar plant in successful operation for several months.

The reports of officers of the Albatross speak very highly of the quality of the light, its applicability to the purposes desired, including submarine lighting, economy and durability.

LIGHTING PENNSYLVANIA TOWNS.—Mr. G. S. Brock, representing the Maxim Electric Light and Power Company, was in Oil City on August 20, conferring with prominent citizens regarding the formation of a company for the lighting of that city by electricity. The outlook is favorable, and an application will be made for a charter. The Maxim Company lights Lancaster, 110 electric lamps taking the place of 589 gaslights, and Reading, with 60 lights. Companies have also been formed at Allentown, Pottsville, York, Pittston and other places.

BRILLIANT LIGHT IN PHILADELPHIA.—The Philadelphia *Record* claims to have the strongest single light in the United States burning nightly in front of its building on Chestnut street, 95 feet above the sidewalk. Its power is equal to 10,000 candles. At night the entire block between Ninth and Tenth is made so light that under the powerful rays of the lamp a person standing anywhere within these limits can read editorial print with ease. It is of the Hockhausen model, and is supplied from a dynamo in the basement of the *Record* building. The street electric lights near by are said to be so overpowered that they cast deep shadows on the sidewalk.

MISCELLANEOUS NOTES.

THE PORTRUSH ELECTRIC RAILWAY.—The electric railway from Portrush to Bushmills, in the North of Ireland, is to be opened with due ceremony by Earl Spencer on Sept. 14.

A NEW ELECTRIC SIGNAL COMPANY.—At Springfield, Ill., on August 17, was incorporated the Marley Signal Company, of Chicago, organized for the purpose of manufacturing magnetic railway signals; capital stock, $300,000. Incorporators—John W. Marley, John F. Henkle and Alfred E. Case.

STOCK QUOTATIONS.—Telegraph, telephone and electric light stocks were quoted on Thursday of last week and Thursday of this week as follows:

	Aug. 23.	Aug. 30.
American Cable	....	60¾
Western Union Telegraph	77½	76¾
Bankers' and Merchants' Tel	....	140
Mutual Union Telegraph	....	15½
American District Telegraph	....	15
Bay State Telephone	120	100
Bell Telephone	239	232
Currier Telephone Bell Co	20	....
Granite State Telephone	85	....
Mexican Telephone Co.	2⅝	2⅝
National Bell Telephone of Maine	80	70
Suburban Telephone Co	125	107½
Tropical Telephone	2½	2
New York and Pennsylvania	92½	91
Boston & Northern Telephone	130	125
Union Telegraph and Telephone	100	....
Erie Telephone	60½	59
United States Electric Light	115	....
Edison Electric Light	280	....
People's Telephone	111	....
New York and New Jersey	98	95

DEPARTMENT OF INQUIRIES.

40. SHORT TELEGRAPH LINES.

I wish some information regarding a short telegraph line which I have constructed. The length of the line is 600 feet. How many cells will it need. Also would it be better to have a return wire or connect with the ground at each end. W. R. H.

Union Mills, N. Y.

If the telegraph instruments used are wound with comparatively coarse wire, and offer but little resistance, say from 10 to 20 ohms, them a battery-power of from two to four gravity cells ought to suffice. If there are facilities for making good ground connections at either end, for instance a water-pipe or a gas-pipe, then a ground return circuit will be very satisfactory. If the connections have to be made by placing metallic plates in the ground, then we should think it would be less trouble to lay a second line. Practically, we may say, that on such a short line there would not be much difference in the result between a circuit using the ground or one using a second wire as the return conductor.

41. THE ARRANGEMENT OF BATTERIES ON LONG LINES.

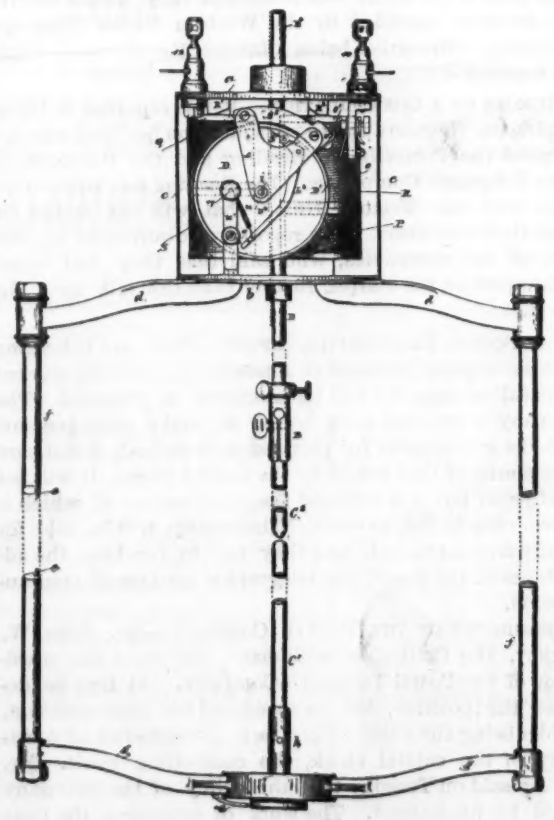
Our railroad train wire is 295 miles long, and I am about midway or 143 from the dispatch end. I find it requires a very fine adjustment to work with either end. I learn that there is a battery of 100 cups, Callaud, at each end. I suggested that 50 to 50 cups be put in the line here, but the Telegraph Superintendent objected, giving as his reason that according to his experience an intermediate battery would make the line work worse. It has not been my observation. All I am after is a good strong wire. Operators on either side of me make like complaints. What is the remedy?

In telegraphic lines, specially long lines, where strong batteries are used, a small portion of the current passes from the wire to the ground at each insulator. The resistance of glass or porcelain insulators is very high, and only the smallest quantity of electricity escapes at each pole, but when the current has to pass by several thousand of these insulators, the loss becomes appreciable. In damp or cold weather, moreover, there is a thin film of moisture condensed on the surface of the glass, and in dry weather the dust is likely to accumulate in a thin layer also, in either cases with the effect of decreasing the resistance to the escape of current. It is because so large a proportion of the current thus becomes "short-circuited" by the poles, that it is found necessary in some cases to increase the battery power during stormy weather. Now, if the battery is stationed at one end only, it is evident that the loss of current by diversion at each pole will reduce somewhat the amount that will be available at the station situated at the other end. To remedy this we place a battery at the other end. When the circuit is closed the instrument at this end, and at the neighboring stations, will respond readily. But this battery also suffers diminution by the diversion of its current at each pole. Consequently the point of weakest current in the whole line will be midway, just as in the above instance. We believe with our correspondent, and several practical telegraphers concur with us in the opinion, that an intermediate battery would remedy the difficulty just as well in the centre of a line as the battery placed at the other end renders the line "stronger" at that end. It seems plausible to us that the placing of a stronger battery, say 100 cells, at the centre, and a weaker battery, say 50 cells, at the ends, would give better results than the present arrangement. Another way to remedy the difficulty is to increase the battery at each end, so that in spite of the diversion at all the insulators between each end and the middle of the line, enough current will reach the midway station to work the instruments properly. It is not unlikely, however, that in this case the stations nearest the ends of the line would work "too strong"—a result which is less likely to happen when the current is more evenly distributed over the line. Perhaps some of our readers can give us additional information on the subject.

ELECTRICAL PATENTS ISSUED

And Dated August 21, 1883.

Apparatus for producing vacuums; Edward Weston, Newark, N. J. 283,549
Apparatus for protecting telephonic and telegraphic instruments; Frank E. Kinsman, New York, N. Y. 283,492
Automatic telegraph; James Webb Rogers, New York, N. Y. 283,665
Dynamo-electric machine; Abram M. Loryea and Chas. H. Palmer, New York, N. Y. 283,498
Dynamo-electric machine; Edward Weston, Newark, N. J. 283,548
Electric annunciator; Edward Flint, Jr., Boston, Mass. 283,590
Electric arc lamp; Charles Richter, Camden, N. J. 283,662
Electric conductor; Henry D. Stanley and George Doolittle, Bridgeport, Conn. 283,433
Electric lamp; Chas. D. Haskins, New York, N. Y. 283,482



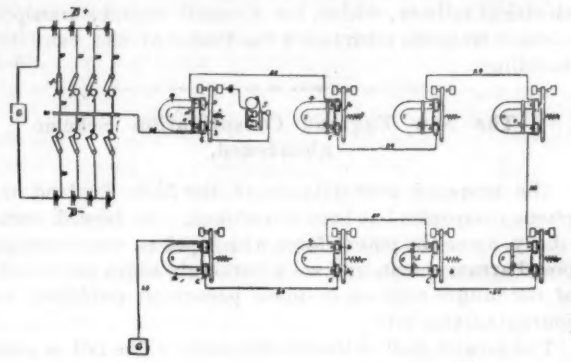
The object of the invention is to employ but one magnet, and by it to raise the carbon for forming the arc, feed the carbon gradually as the current to the carbon weakens, release the carbon holder, so that it may slide down to restore contact, if broken, and then immediately separate the carbons by a powerful magnet and armature lever as soon as the current passes through the lamp, and thereby draw the electric arc; and in case the carbon breaks or the lamp fails to work an automatic switch is brought into action to short circuit the current between the + and — binding posts and cut out the other parts of the magnet helix; but the moment the current is re-established through the carbons the switch is moved and the shunt circuit broken, so as to re-establish the lamp in its operation.

Electric lamp; Hiram S. Maxim, Brooklyn, N. Y. 283,629
Electric lamp; Elihu Thomson, New Britain Conn. 283,437
Electric meter; Edward Weston, Newark, N. J. 283,547

Claim.—1. The combination, with a main circuit and multiple arc or derived circuits, of a motor and a register for indicating the number of revolutions of the same, the field of the motor being included in the main circuit and the armature in one of the multiple arc or derived circuits as and for the purpose set forth.

2. The combination, with a main circuit and multiple arc or derived circuits, of a combined register and unloaded motor, the field of said motor being included in the main circuit and the armature in one of the multiple or derived circuits, as and for the purpose set forth.

Electro-magnetic motor; Edward Weston, Newark, N. J. 283,546
Individual call; John Cornelius Wilson, Boston, Mass. 283,448



The invention consists of a central station and circuit leading therefrom through a number of different stations containing signaling instruments, the controlling electro-magnet of each of which has its cores charged with magnetism of a different amount or character from that of any other of the instruments. The instruments are shown as consisting of a magnet and movable armature and retractor, the magnet consisting of a permanent steel horseshoe magnet *a*, having fastened upon its poles soft iron cores *b* upon which are wound the coils *c* of insulated wire included in the main circuit 20 common to all the instruments. The iron cores *b* are permanently charged with magnetism of the same polarity and strength as that of the poles of the permanent magnet to which they are attached. The amount of magnetism imparted to the soft iron cores may be regulated by the bar *d* adapted to be clamped in contact with both legs of the magnet. The nearer the bar *d* is clamped to the cores *b* the less the amount of magnetism induced in the cores by the magnets, so that the amount in the cores may be regulated to a nicety. The permanent polarity of No. 1 is the same that would be produced by a negative current of unit strength; the permanent polarity of No. 2 is the same that would be produced by a positive current of unit strength. No. 3 has magnetism equal to that produced by a negative current of two units' strength; No. 4 is equal to a positive current of two units; Nos. 5 and 7 are equal to three and four units of a negative current, respectively; Nos. 6 and 8 are equal to three and four units of a positive current, respectively. Two batteries marked *B* + and *B* — are shown. Those marked + have their positive poles connected with the circuit, and those marked — have their negative poles connected with the circuit. The current from each battery will produce a unit of magnetism in the cores. If the circuit of battery No. 1 is closed, as shown, a unit current from the positive pole will pass through the circuit, and the permanent magnetism in magnet No. 1 being the same as would be produced by a negative current of unit strength, all attraction is neutralized and the armature is withdrawn by the spring. The current passes to magnet No. 2, where it increases the magnetism to two units, as the signs are alike. The other magnets are either increased in strength or decreased the amount of one unit, but there is still left sufficient magnetism to hold the armature. The same effect is caused by making other connections; only the magnetism, which is produced by like number of units, but contrary polarity, will permit its armature to fall. The magnets control signal instruments.

Signaling apparatus for telephone exchanges; Thomas D. Lockwood, Malden, Mass. 283,626
Telegraph transmitter; Henry Lyon, New York, N. Y. .. 283,716
Vacuum pump; Edward Weston, Newark, N. J. 283,545

BUSINESS NOTICES.

THE UNITED STATES MUTUAL ACCIDENT ASSOCIATION, Nos. 320 and 332 Broadway, this city, the original and the largest mutual accident association in the world, has in force over $70,000,000 accident insurance, with weekly indemnity amounting to $18,000,000 per annum. The membership fee for $5,000 accident insurance with $25 weekly indemnity is $4 payable but once. Annual dues thereafter $1.

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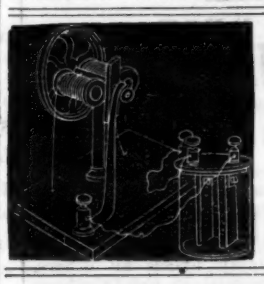

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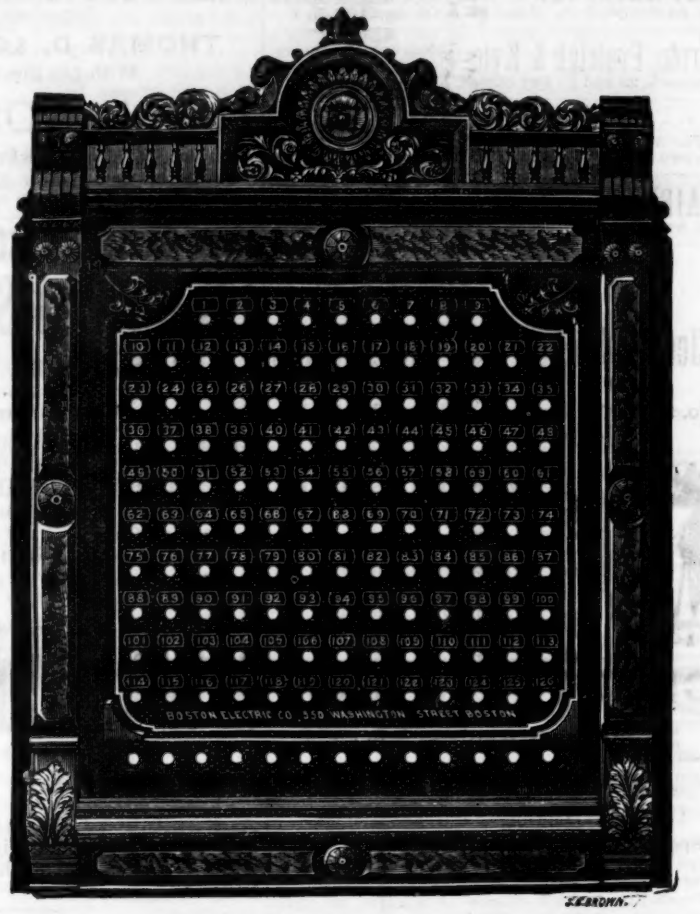

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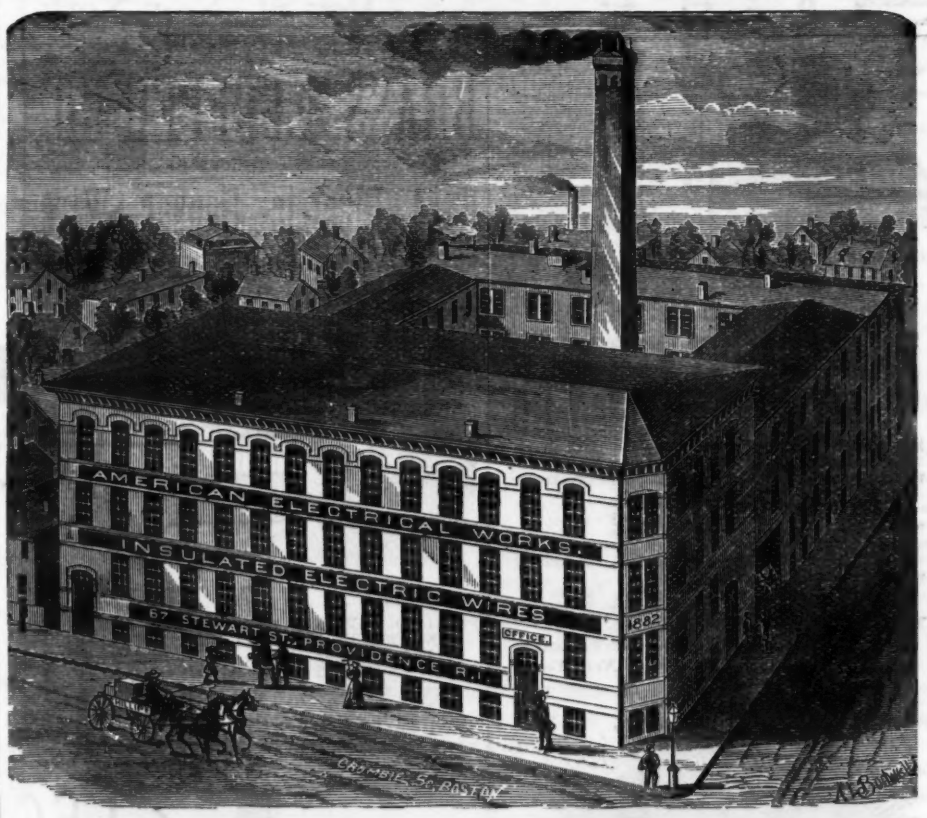

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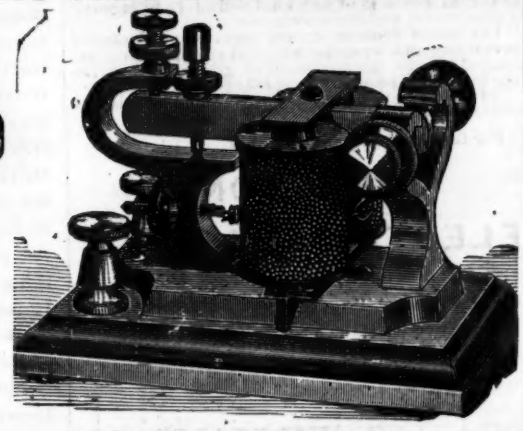

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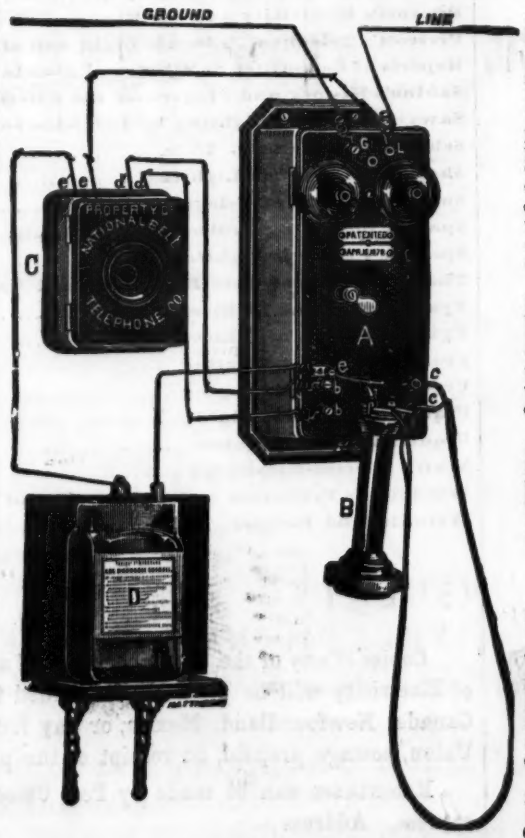

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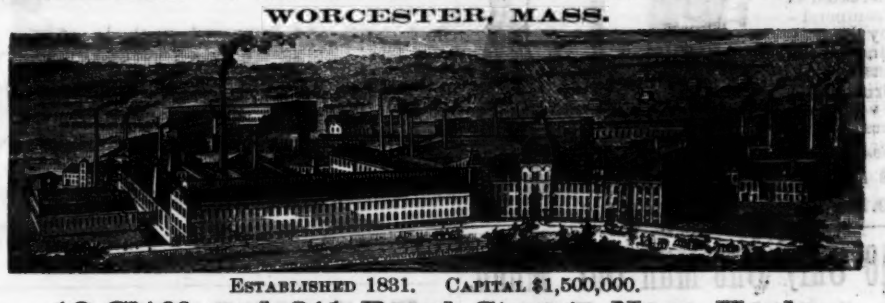

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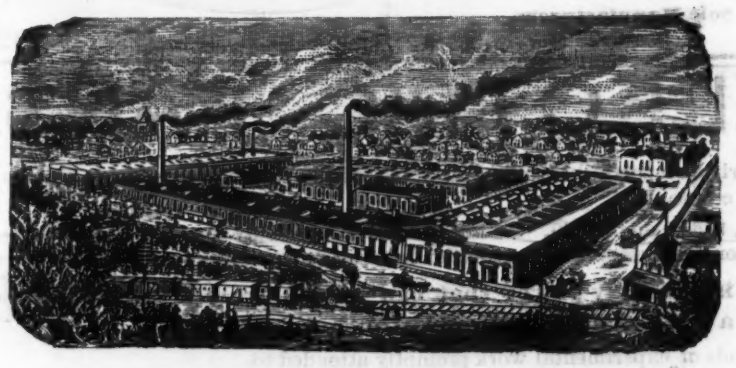

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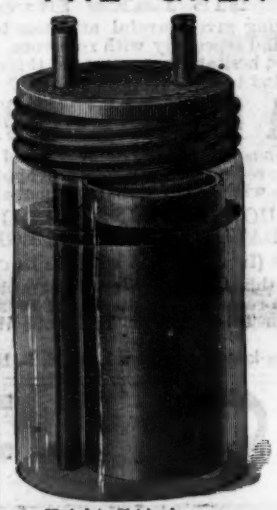

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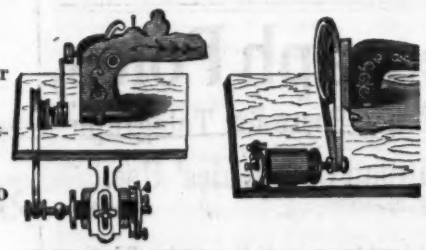

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